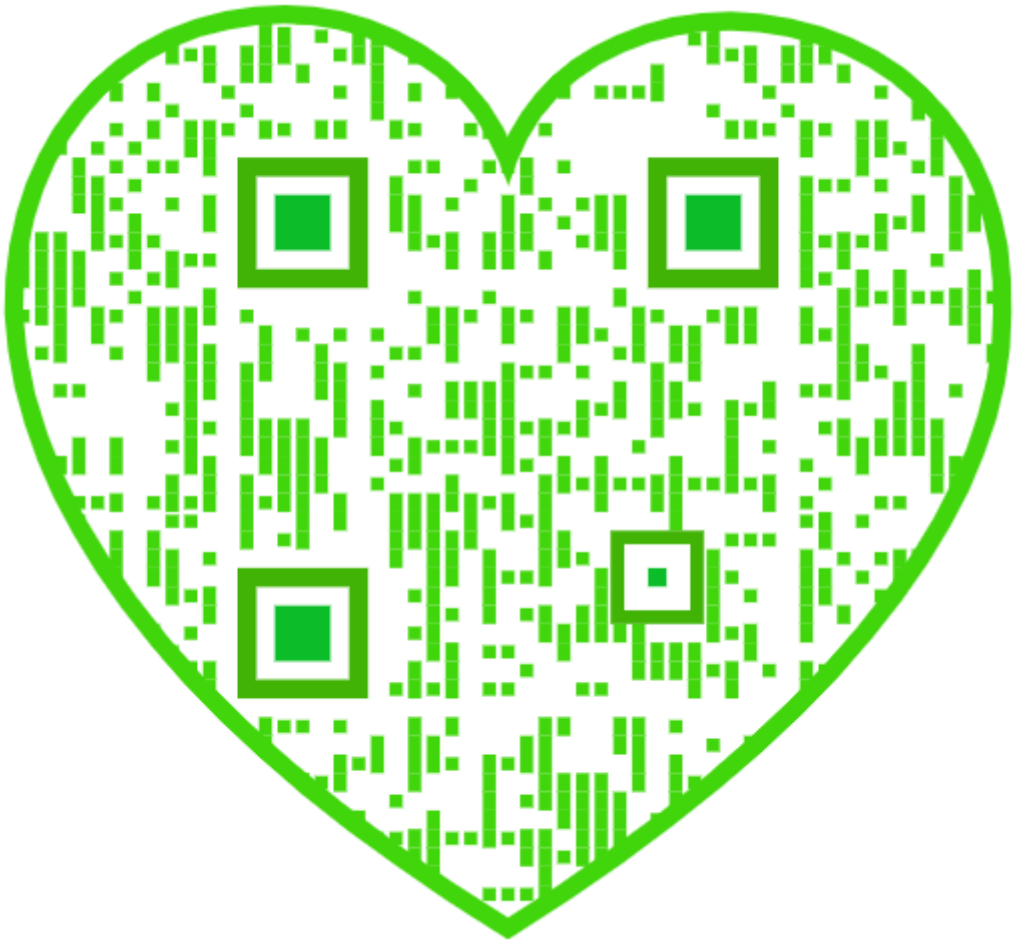

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MODERN STRAWBERRY GROWING

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GOOD TO THE BOTTOM

Pack honestly when sending it to market, and have the same grade of berry all through the box

Modern Strawberry Growing

BY

ALBERT E. WILKINSON, B. S.

Instructor and Investigator in Horticulture
New York State College of Agriculture
at Cornell University

UNIFORM WITH "THE GARDEN LIBRARY"

ILLUSTRATED

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PREFACE

It is more than twenty-five years since a complete book on this subject has been published.

It would seem that this particular crop had been somewhat neglected except for the work of the horticultural experimenters at the various State and Government Experiment Stations, and through reports published in the farm papers of the work by practical growers. All this available material on the subject has been taken and "boiled down" in the shape of a practical book, in the interests of the general farmer and amateur gardener, so that they may produce a more than liberal quantity of this healthful, delicious fruit for their own use, and obtain more real pleasure and benefit from a small plot of land intensively devoted to this crop than from any other crop requiring the same amount of care and attention.

The old cry that "the strawberry industry

is being overdone" is not founded on facts. At any time of year, in practically any market, the supply of first-class, well-packed, high-priced berries is never equal to the demand. There is, however, in some cases, owing partially to the lack of a proper packing standard, or growers' organization, and partly to the oversupply in some markets of a very poor fruit, a glutted market on strawberries for a short time, but these are not the high-class fruit.

In the words of the law on supply and demand, "Demand is increased by a crop of well-grown, well-packed and properly sold fruit."

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MODERN STRAWBERRY GROWING

MODERN STRAWBERRY GROWING

CHAPTER I

Selection of Site

In the selection of a suitable site for a strawberry plantation there are a great many environmental factors to consider, the principal ones being climate, slope or exposure, drainage, kind of soil, and condition of the soil. Considering these factors in their order, and viewing the advantages and disadvantages, with the ideal in each, will give the prospective strawberry grower some idea of just how near to the best selection he is able to come, and may help in correcting and improving his choice of site.

It is often stated that this or that variety is particularly adapted to the South, West, or North, in other words, that these varieties

can, or cannot, withstand the long cold of the North or the frosts (both early and late), or they cannot stand the excessive heat or sunlight of the South or mid-South.

This adaptability is not surprising, since we recognize such things as "plant associations" or "societies" in which a certain group of plants live together under certain conditions of climate, moisture and other factors. And it has been found that by selection and breeding, or both, either natural or artificial, it is possible to change the requirements of a plant so that it is more adapted to a condition of cold weather than it is to hot weather, or vice versa; or it has changed its characteristic choice for great moisture to a liking for drier conditions; or in some other way it has been so modified that it can and does live under different environment or surroundings than it required in earlier stages of its development.

Applying this idea to strawberry plants originating in the South: They can be brought North, and in a few years their descendants will be, or can be made to be,

quite used to the conditions of the Northern climate or other external factors.

SLOPE OR LEVEL

If there is a choice between a slight slope and a level piece for the strawberry bed, it is advisable to take the former. This must not, however, be too sharp an incline, but rather gentle or slight. The advantages of such a selection will be better water drainage and lessened frost injury, owing to some air drainage. The disadvantages may be some washing of the land, and therefore loss of humus and soluble plant food.

The southern slope should always be selected for early fruiting; but for late fruiting, where the plants are held back until all danger from frost is past, a northern slope is best. This northern slope should, however, be somewhat protected in our Northern States by either a tree, shrub, or building windbreak; otherwise the plants will suffer greatly from cold high winds.

One of the principal drawbacks to southern exposures is the frequent freezing and thawing, especially of the honeycombed variety, which causes heaving of the plants and

destroys great numbers yearly by breaking the roots of the plant and leaving the plants and some roots exposed to the sun. Owing to the warmth of this location blossoms start early and are sometimes killed by late frosts.

If there remains only a level place for the bed, and it is not well drained, this may be overcome by installing some proper drainage system, such as a stone or tile drain. The proper way of putting in a drainage system is given in some of the books on soils or on the physics of agriculture, and will not be discussed here.

If this level place be situated lower than the surrounding land, it is not advisable to use it, owing to its being a settling ground for heavy cold air, which means greater liability to frosts. In fact, low lands are the least desirable of all for a strawberry bed.

As a general rule we find that strawberries, as a whole, are cosmopolitan as to the kind of soil, whether it be clay, sand, or gravel. We can find many varieties, such as Senator Dunlap, Sample, and Bubach, that will produce good crops of fruit anywhere, and so are considered by many as not limited as to kind of soil, owing to their great success

under all conditions of soil; but, coming to a closer examination of the growth of the plants and the largest yield of the largest and best fruits, it is found that each variety does have the peculiarity of doing better in some one kind of soil than it does in others. Thus, we find that Lady Thompson, Stevens, and Clyde are more adapted to sandy locations, while Wm. Belt, Parsons Beauty, and Glen Mary require a heavier soil, and Gandy's largest crops are produced on a heavy clay.

The ideal soil is a good, rich, humus-containing loamy soil, which is well drained.

The one condition of soil on which it is never advisable to plant strawberries is fresh-ploughed old sod. Several reasons are back of this: First, an air space between the subsoil and the turned or ploughed sod. This is practically impossible to overcome, even after several rollings and diskings. Second, the large number of insects present, especially the June bug lava, or commonly known "white grub." This fellow eats off the roots of the strawberry plants, killing large areas which have been planted in sod. Third, owing to the first reason, lack of

water in the topsoil, as there is a break between the topsoil and the subsoil and therefore a lack of rise of soil water. Even with several waterings the plants are not saved where there is a break in the capillarity.

The question then arises if the only available place for strawberries is in sod, how shall one go about in order to plant strawberries the next spring? Fall ploughing and not inverting the sod is the solution. This kills the grubs, starts the decay or breaking down of the sod, and gives a greater chance for connection between the upper soil and subsoil. The preparation before planting, however, must be the most thorough possible.

CHAPTER II

Manuring and Fitting

After the selection of the best available site for the strawberry bed has been made comes the immediate work of preparing the land for planting.

The question would naturally arise: If the grower was given either sandy or clayey soil, just what line of work would suggest itself as the best for the largest returns in crops of fruit? If the individual has one or the other kind of soil, and can apply stable manure, or grow a crop to turn under, some of the various results obtained from such applications would be expected — that is, by adding stable manure or ploughing under a crop of clover, rye or other crop (green manuring), it is possible to improve the texture or physical condition of the soil to such an extent that the soil is able to hold more water, more air, give the roots of the

plants more feeding space, make it easier for the roots to penetrate the soil, increase the bacterial work of the soil, aid chemical liberation, thereby causing more plant food to become available, and many other helps to larger and better crops. This then would be the first step.

The second would be to crop the land for a year or more with a crop such as corn, potatoes, or beans the first year, and if possible the same the second year, adding a cover crop for each fall and winter, being sure that at the beginning of the third spring there will be a good cover crop of some legume, like clover, to turn under, following this by thorough preparation of the land and planting to strawberries. This method would have so changed the original conditions of the soil that it would be reasonable to expect a good crop of fruit.

These principles herewith given are the ideals as set forth for the most intensive growing of strawberries, and they are the methods in practice to-day by the majority of the successful commercial strawberry growers.

If the land is in fairly good tilth, and has

not required making over, the work of manuring can begin at once.

MANURING

Many growers like to manure heavily in the fall, applying from fifteen to eighteen cords of stable manure to the acre, and ploughing under, it being practically impossible to apply too much manure. Through the winter this manure has a chance to break down somewhat and begin to, or is ready to, decay when the first opening of spring comes. There are other growers that do not spread manure until after they have ploughed the land in the spring, preferring to disk in the manure, following this by a light cross ploughing, thereby putting the manure at the best depth for the strawberry roots. Many of these growers claim that manure ploughed under in the fall is placed too deep for the use of the plant and therefore is not so available for the current year's growth of the plants.

It is also claimed that during the winter there is some loss of the food from the manure ploughed under. Some advise only eight or ten cords of manure, supplementing this with

one or two applications of commercial fertilizer, such as wood ashes and ground bone, at the time of setting the plants, and a little later about 300 pounds of wood ashes and 500 pounds of ground bone being used per acre. The latter method could be used by the commercial grower to great advantage, as it would save labour and might be cheaper. For the intensive farmer and small grower or fancier heavy applications of stable manure would be most desirable and would be found to be cheaper in the end.

The cost of manuring will figure out like this:

1st plan.	15 cords of manure at $2.50 per cord		$37.00
2nd plan	10 cords of manure at $2.50 per cord		25.00
	300 lb. wood ashes at $16 per ton	per acre	2.40
	500 lb. ground bone at $32 per ton	per acre	8.00
			$35.40

Ofttimes the manure can be obtained for the handling, or is produced on the property and in that case it is the most advisable and economical to use.

PLOUGHING

In ploughing the land the grower must first decide whether to plough in the fall or in the spring.

The advantages of fall ploughing are:

1. At this time of the year the grower can do a better job and with less haste, owing to there not being so much other work demanding his time.

2. It has a tendency to start the decay of vegetable matter in the soil.

3. Action of frost is very beneficial in breaking down, and thereby fining the soil.

4. Kills many insects.

5. Enables the grower to start working on the land earlier in the spring, as the soil dries out more quickly.

6. Good time of year to turn under fresh manure.

7. In some cases catches and holds large amount of moisture.

The disadvantages are:

1. In certain places loss of soil by erosion.

2. In certain places loss of plant food by erosion.

3. In certain places the soil becomes too dry.

Contrasted with the above are the advantages of spring ploughing:

1. Ploughing immediately followed by harrowing, then planting.

2. Thereby very little loss of soil moisture.

3. Permits a cover crop to winter on the soil; stops erosion.

The general advice for the different soils is: Plough a damp or clay soil in the fall and if planting is to be done on sod; otherwise spring ploughing is advisable, especially where a cover crop is desired or where the soil is sandy.

The question now arises, How shall the ploughing be done? It is best to turn a furrow at least fourteen inches wide, and not completely inverting the soil but having it lap over a little on the preceding furrow slice. It is also important that the soil shall be plowed to a depth of seven inches or more, or, in fact, to the subsoil. If the topsoil is thinner than seven inches, then it would be advisable to plough only a little deeper than the topsoil.

The plough that is used must break up these slices as much as possible and leave them in as good a condition for harrowing as possible. Other than the above, the ploughing must leave the best straight furrows, even, well broken, and all ready for the harrow.

What kind of a plough will give these results?

CULTIVATE!

Constant stirring of the ground about the strawberry plants is as important as feeding the land itself

LIGHT WORK AND PROFITABLE

Keep the boy interested in the farming ventures. Give him a share of the profits as well as a share of the work

A plough that has a rather long point with a well turned moldboard. In my experience a good one is the Syracuse Landslide plough. There are also many other ploughs that will do as good a job.

HARROWING

When the spring opens and the soil is fit to work, if the land has been fall ploughed, harrowing can start. This consists of dragging a pulverizing tool back and forth across the field. The disk harrows are the best tools for this purpose, and by using these, lapping one half each time, the soil can be put in very good condition for the finer harrow. If the soil is inclined to be lumpy or contains much clay or coarse fibre, it is oftentimes advisable to cross lap disk, thus breaking up these particles and leaving the field in finer tilth.

Immediately after disking, use the common spike tooth harrow or spring tooth, set shallow. This tool not only fines the earth more than the disk, but has a tendency to keep the land level. It is advisable to lap the tool one third and cross lap harrow if the soil is not in the required condition.

By working with both disk and spike harrows, the soil is put in very fine, level tilth and this fineness is carried to a greater depth.

BACK FURROWING

Oftentimes the grower wants his soil to have even better preparation than the harrows are able to give, or he may desire to lay off his land in beds. The method used in this case would be back furrowing, ploughing four inches deep, either by splitting the piece in the middle and ploughing, by throwing the furrows together, or by making several small beds, by back furrowing in the middle of a narrow strip, then starting another the same way, leaving a dead furrow between the beds.

While ploughing, the furrows are raked down, thereby leaving a very even, well-raked bed, having all the coarse material at the bottom of the furrow, and the top four inches in the very best possible condition for plant growth.

Sometimes just before back furrowing, which is generally cross ploughing, a good layer of well-rotted manure is spread and this four-inch ploughing is considered by

many growers to place the manure in the most available spot for the growth of the strawberry plants.

Level beds, with all the coarse material well covered, tend to increase the efficiency of labour, by making it possible to make straighter rows and decreasing the time required for setting the plants, and make cultivation and weeding easier and quicker. They also improve the many soil factors, improving the water-holding capacity, giving more air, more bacterial activities, and other beneficial results from more intensive culture.

ROLLING

Rolling after harrowing is used by some growers to enhance the capillarity activities, thereby resulting in a more sure catch of the roots of the plants. This rolling also results in a more even, level surface, which makes it easier and quicker for the grower to mark out the rows for the plants.

The best roller for this work, on average strawberry soils, is the large wooden one. The heavy iron roller packs the earth too tightly, and, therefore, is not so desirable to

use except on very sandy soils. On clay soils use a planker.

After a roller has been used and the plants set, it is important that a soil mulch be given; otherwise, great loss of water from the soil will result.

CHAPTER III

Marking and Planting

There are many systems or methods of marking out a strawberry bed. Much depends on the system of planting which is to be followed. If the plants are to be set in rows four or five feet apart, it will be necessary to have some form of marker that will mark four or more rows at a time. One of the best is that made of a piece of two by three scantling, at least seventeen feet long. For marking rows four feet apart, set in the scantling every four feet, either short pieces of a broom handle one and one half feet long, or iron rods, with some arrangements as to shafts if it is to be used for horsepower, or two short shafts if it is to be run by man power.

At the ends, or near the ends, a short piece of wood (it might be well to allow the outside broom handles to extend above as well

as below) should extend above the scantling to serve as handles by which the marker is kept in place. This machine can be run by three men or one horse and two men — one man, or the horse, to draw it, one man to keep one of the outside markers in the line just previously made, and the other man to drive and keep the machine running parallel to the preceding lines. In starting this machine it is best to begin on one side of the bed, preferably the straighter, if necessary laying out by line or with stakes the first row; then, as the outside marker always coincides with the previous row, it is quite easy to keep each row straight and, of course, the required distance apart.

Some growers prefer chains instead of wood or iron bar markers. They are put on the scantling in place of the broom handles the required distances apart, in order to mark the rows as wanted. The chief objection to chains is the fact that they sometimes do not mark the rows an equal distance apart, owing to their being dislodged or thrown out of place by obstructions in the soil.

Sometimes the common garden line is used very successfully, especially if the oper-

QUICK PLANTING

Two men work together, one carrying and inserting the plants, the other making the hole and tramping the soil down after setting

PLANTING

Planting with a spade is usually the most satisfactory way for the home garden. The whole process is shown above. Set the crown a trifle low so that after firming it will be on a level with the surface of the soil

ator in planting does not touch it. Many times, however, the operator varies the line by pushing the trowel or spade against it until the planted rows bow out when the line is released.

On small beds, where the plants are set one foot apart, a small hand marker, somewhat similar to the large marker previously described, can be used quite successfully, providing the operator has something like the garden line to go by. If this bed is to be check rowed, the same tool can be used, or if the planter has a sure eye for distances the plants can be set without cross marking.

One of the most common methods of marking out a bed is that of ploughing furrows four to six inches deep where the rows of strawberries are to be, the plants being set on the land side of the furrow.

Some of the objections to this method are:

1. Inability to make straight rows.
2. Breaks up the level bed, making it rough.
3. Not an intensive method.
4. Labour of filling in furrow.
5. Plants liable to dry out.
6. Hard to place plants at the best depth.

The advantages are:

1. Quickness of opening furrow for planting.

2. Quickness of setting plants, it being necessary only to set the plant against the straight edge of the furrow, and place soil around and on the roots.

3. Ease of watering plants after being set.

4. Cheapness of setting.

5. Best method for matted row culture where the planter is short handed.

RECEIVING PLANTS

As soon as the plants arrive at the station, get them at once, take them home, unpack the box without delay, and, if you do not immediately plant, dig a shallow trench and place the plants in this. Be sure that the bundles are untied; be sure that the soil is moist and packed firmly around the roots. If there is any trouble with the plants, such as mould, or the plants are of poor quality, notify the dealer at once, writing exactly the trouble, and make a settlement with him.

Notice the roots of plants you buy. If they are black or dark coloured, better not

take the plants, as they are old. The best plants have light yellow, sometimes light orange coloured roots, which denote that the plant is young. If there is a good, well-developed root system, so much the better.

The leaves should be light green, fresh and new looking.

PLANTING

If the grower has used the furrow method of marking out his strawberry bed there will be very few tools needed to set the plants. Some growers use a trowel to place the earth around the plant, but for quickness and efficiency of labour there is not a tool that will equal the hand for this work. Following this placing of the soil around the roots of the plant, use the feet or the knees to firm the soil. However, there is quite a large amount of soil to replace in the furrow, and this can best be done by horse tools, such as the five or seven shovel toothed cultivator. Almost every farm has these tools, so the beginner would be put to no extra expense for tools by following this method.

The best tool to use in the case of planting to the mark or line is the ordinary garden

spade. By this method two men or two men and a boy are needed. In the case of the two men, one uses the spade, thrusting it into the soil at the required distances apart, pushing the handle forward a little, thereby making openings in which the other man can place the roots of the strawberry plants, being sure to spread them as much as possible. The spade is then placed in front of the plant and pushed into the ground and the blade drawn back, forcing the soil tightly against the roots of the plant; or the heel is placed near the plant to force the soil tightly against the roots. The man who sets the plants in the ground must prepare them if it has not previously been done, by pruning the roots back so that they will be able quickly and easily to start growth; also the leaves must be pruned. If you prune the roots, be fair to the top and prune back all the leaves but one (this should be the last one produced by the plant), and the growing point. The planter must also carry the basket of plants or the pail of plants, if a boy is not employed to prepare and drop the plants.

The best results in planting are sometimes

brought about by keeping the plants, while they are being carried about in the field, with their roots submerged in water.

The proper depth to set the crown is another point that the man who sets the plants in the soil must be very careful about.

Sometimes the crown (that part of the plant where the leaves and roots start) is planted so deep that the growing point is not able to push its way through the soil; the plant lives for a while and then dies. Again the crown is not set deep enough and some of the roots are exposed. In this case the plant lops over, the exposed roots dry out, and the plant dies.

Now, since the above is so, the question is, "Just what depth is correct in setting strawberry plants?"

It has been found that the proper well-set plant is one that has all of its roots and the lower part of the crown covered with soil; or, in other words, the top of the crown should be a little above the level of the ground. This enables the growing point to develop without hindrance, and prevents the drying out of the roots from exposure. The results will be quick, satisfactory growth.

The plants can be set with a hand trowel in place of the spade. At the proper point on the mark or under the line, the trowel is pushed into the soil and the handle is brought forward and sideways, making a hole four to six inches long and deep, and about an inch wide at the top; the plant is laid flat on the ground with the top of the roots near the crown over the hole. Then using the edge of the hand the roots are pushed down into the hole and are well spread; the plant is then held at the correct depth with one hand and with the other hand the trowel, back toward the plant, is thrust into the soil about two inches from the plant followed by a quick motion on the trowel toward the plant. The earth is firmed around the plant. Following this the operator can step on the soil, firming it more thoroughly, but this is not necessary. The next plant is then set, and so on.

There is still another method which is sometimes used on the home grounds or in small beds. This consists of removing the plant from the propagating bed with the greatest amount of roots, and a large lump of soil. The tool used consists of a round piece

of galvanized iron or steel, about four inches in diameter and six inches deep, with a handle about two feet long, consisting of two pieces of iron joined at the top and attached to the round piece on opposite sides. In using this tool, it is placed over the plant, having the plant in the centre, the foot or hands press the instrument into the soil, cutting a round piece of soil the size of the tool. By canting the tool a little the plant and soil can be removed and at once set in the bed where wanted. Of course there must be a hole a little larger than the transplanted soil and plant requires, and the plant must be set with regard to proper depth.

The advantages of this method are:

1. Does not require root or leaf pruning.

2. Has a tendency not to check the growth of the plant.

3. Sure success in transplanting.

The disadvantages are:

1. Extra cost of labour in transplanting, as the method is a slow one.

2. Not of value commercially, owing to extra cost as above.

3. Cannot be used if grower has to buy plants.

WHEN TO SET THE PLANTS

There are several considerations which govern the time and manner of setting strawberry plants. The time to plant depends in humid regions more upon the rainfall than upon any other factor. If the seasonal rains occur in July and August, plant then; if in September and October, plant at that time. If the earlier date can be taken advantage of, so much the better; the plants will have a longer period in which to grow, and they will be stronger and the crop heavier in consequence.

If there are not timely rains at the planting season to give the plants an opportunity to establish themselves, the stand will be uneven, with the result that more work will be required to keep the land free from weeds, and it will be more trouble to get the blank spaces occupied by runners from the plants that survive.

The plants that do withstand the drought are checked and dwarfed. They seldom recover so as to make either satisfactory

THE MATTED ROW IN FULL BEARING

Notice the clean, bright straw, serving to mulch the soil, preventing loss of water by evaporation, and protecting the fruit from contact with the soil

MATTED ROW SYSTEM

Not an intensive method for growing strawberries; however, it is the system used by the majority of commercial growers

croppers or plant producers. It is most satisfactory and economical, therefore, to choose that season which offers most advantages at planting time, other things being equal.

It is impossible to specify the season for each locality or even for large areas, as conditions of soil and climate necessitate different practices in localities only a short distance apart. In general there are only two seasons for planting, spring and fall, but in some localities spring planting should be done in April or May by the use of the preceding season's plants, while in others it may be done in June from the crop of runners of the same season.

In irrigated regions planting can be done at whatever season the work will give best results in future crop production. In humid regions rainfall is the determining factor. In the northern half of the prairie region west of the Mississippi, spring planting gives best results. In the Middle Atlantic States, the work is divided between spring and August planting, with the balance in favour of the latter in some localities. In New England, the work is chiefly confined to the spring months, although there are enthusi-

astic advocates of fall planting, especially among those who combine strawberry growing with the trucking business on expensive lands near the large cities.

In the Atlantic Coast States south of New York, August and September planting is most extensively practised, particularly upon the more retentive soils. In the trucking region on the islands about Charleston, S. C., spring planting is practised, as it results in a paying crop the following year, while only a small crop can be harvested from fall-set plants. On these quick soils, the plant can be grown as an annual; and farther south, in Georgia and Florida, the fall-set plants will return a profitable crop the following spring. On the heavier soils of South Carolina, however, fall planting, with the paying crop one year from the following spring, is the most profitable method.

WATERING

After the plants are properly set it is often necessary to water them, particularly if the soil is quite dry when the plants are set. This may be done by using watering pots, by the use of a spray machine, by irrigation

both overhead and by trenches, or, on the home acre, by using the hose.

It does not seem best at this point to go into the process of irrigation, it being deemed only necessary to say that enough water should be applied so that it will thoroughly moisten the roots of the plant, and by so doing help to make more points of contact between the soil particles and the roots.

This first watering is often helped by the proper removal of the leaves when the plants are set, thereby decreasing transpiration, (the amount of water the plants throw off), and resulting in a lessening demand of the plant for water.

SYSTEMS OF PLANTING

The matted row.—The most common system of strawberry growing throughout the United States is the matted row system. This is particularly popular where berries are sent to the canneries, on large commercial plantations, and where farm labour is scarce or not reliable. The reason for this is because less labour is required in setting and caring for the plants, and the crop of fruit is larger.

After the plants are set in rows which are three to three and a half feet apart, with the plants from eighteen to thirty inches apart in the row, the runners are allowed to have full swing and develop as many plants as they will.

In cultivating, the machine is only run in one direction, and as the plants spread the cultivated space narrows until twelve or fifteen inches at its greatest width.

The greatest drawback to this system is that many great plant-producing strawberries are allowed to set their plants too close together, resulting in a somewhat smaller crop and quite small fruit, which of course will not bring the highest price in the market, and also costing more in time and money to pick. Careful attention to the proper thinning of the plants in too heavily set matted rows will obviate this drawback.

Single-hedge row.—This method is quite well adapted to a more intensive system of strawberry growing. The main idea is to set out the plants in rows two to three feet apart, the plants being twenty to thirty inches apart in the row. Each plant is allowed to produce two runners, and one

plant is produced on each runner. Other runners are clipped off as soon as they are produced.

These two new plants are trained to grow in the row of older plants, being likened to the method of setting a row of plants, each plant being one foot distant from its neighbour in the row, and allowing no runners to grow.

The great advantages of this system are: larger developed plants, tending to larger fruit; ease of cultivation, but more expensive, owing to the fact that runners must be cut, and during the growing season strict attention must be given.

Double-hedge rows.—A system which is a development of the single-hedge row idea, in which the mother plant is allowed to set either four or six plants instead of but two. These plants are trained to form three rows, one being in line with the older plants and a row each side of the mother plant row, each plant having a certain allotted space, which permits ease in hoeing and cultivation, also eliminates crowding, permitting plenty of sunlight and air to reach each plant and giving a heavier crop of large berries than in the single-hedge row.

The plants are set thirty inches apart in the row, the rows three feet apart, allowing, when the plants are grown, about one half the space for the plants and one half for clean culture.

The hill system.—The most intensive system of strawberry growing, in which the plants are set from one foot apart each way, to one foot apart in rows eighteen inches to thirty inches apart, the plan being not to allow any runners or new plants to set, but permitting the plants to grow to great size, believing that more and larger fruit of better quality will result.

A very good application of this system is that carried on by a grower in New Jersey. His beds are marked out four feet apart, with a path between the beds one foot nine and three fourth inches wide. These beds are of any length desired. The plants are set out one foot apart each way in the four-foot beds. By planting at the edge of the bed, near the path, there will be five rows of plants across each bed. The number of plants required for an acre is 33,795 or 1,940 plants for a space 25 by 100 feet. His results have been wonderfully great. His method has been

highly recommended by many who have investigated.

This system, being so very "intense," requires heavy manuring and fertilizing, as well as constant cultivation and attention to runner cutting. The plants are very large, are well supplied with blossoms in the fruiting season, and are loaded with fruit later.

A plan somewhat similar to this hill system was used in England many years ago, the plants being hilled instead of grown under flat culture, and no runners allowed to form. This system is particularly adapted to the small grower, especially if the land is high priced. It cannot be used to advantage by the large commercial grower owing to the great amount of labour required, resulting in heavier expense.

COMPANION OR INTER-CROPPING

The strawberry is a fine plant to use at the time of setting out a young orchard. Strawberries can be planted between the rows of trees and thereby give returns to the grower long before the trees could possibly produce any. The strawberry is considered by some people to be the very best

crop for inter-planting in an orchard for the following reasons;

1. It does not rob the trees of plant food.
2. It does not rob the trees of sunlight.
3. It requires good cultivation; the trees are benefited by this thorough working of the land.
4. It requires fertilizing or manuring.
5. Strawberries require some attention. At the same time the grower becomes acquainted with the trees.

HOW MUCH TO PLANT

From twenty-five to one hundred plants well cared for will answer for the majority of families who have but small space to give to growing and little time to caring for the plants.

The majority of farmers, owing to the possibility that labour will be scarce during weeding time, or the hens getting out, or some other cause, require a larger bed. About 100 to 250 plants, well set, will give returns enough for the farmer's family. This of course may be regulated by the size of the family and the attention given to the bed.

HEDGE-ROW SYSTEM

Training the runners of the plants so that they will grow in a single or double hedge row is a type of intensive culture highly recommended

HILL SYSTEM

The most intensive system of growing strawberries outside is by the hill or individual plant method

In the case of the specialist, some would do better on less acreage better cared for, while others have no limit to the size of the plantation they can handle profitably.

Some of the factors that the specialist must bear in mind are:

1. His own ability as plant producer, fruit grower and business man.

2. Adaptability of his land to strawberry growing.

3. Markets catered to, demands of the same as to berry packing, package, season, etc.

4. Advisability of advertising, etc.

It is advisable for all three classes of growers to start slowly with a few varieties, building up as the demand warrants. After a few years' test on a small plot of some of the newer and more promising varieties, introduce the best and cater strictly to the largest money getter.

CHAPTER IV

After Care — Fertilizers

It is hardly possible to make the soil too rich for strawberries. Hence it is desirable that available plant food should be present to meet all the requirements of the plants, particularly with the mineral element phosphoric acid, both soluble and available.

There are several ways and materials by which it is possible to supply this food demand. Coarse manures, turned under very early and thoroughly incorporated with the soil, will begin to decompose before setting time, the foods thereby being in some supply at this time. Cover crops, or crops grown particularly for green manuring, will also serve the same purpose as coarse manure; in fact, where a supply of the latter material is not available, the green manuring will satisfactorily take the place of the other material, especially if the deficiencies in

plant food required are made up by minerals, such as nitrate of soda, acid phosphate and muriate of potash.

The statement is often made that well-rotted manure, thoroughly worked into the soil, is the best fertilizer. This is quite true in the majority of cases, especially where an abundance of the material is used.

Why is this so?

1. Manure contains a large amount of vegetable material, sometimes called humus, which improves the physical conditions of the soil by:

(*a*) By making a clay soil less compact, resulting in a more open and porous soil.

(*b*)By making a sandy soil less leachy and porous.

(*c*) By making both these soils retain more water, thereby somewhat preventing drought.

(*d*) By permitting ease of root growth.

(*e*) By giving the roots greater feeding surface.

(*f*) By increasing the activities of the soil, thereby increasing the available plant food, etc.

Oftentimes, from lack of humus, low

yields result. This is especially so in dry seasons.

2. Manures contain a fair amount of plant food which on being decomposed is available to the plants, nitrogen being the predominating element. It has the drawback though of not containing a balanced food ration. This may, however, be remedied by supplying the deficient elements with a subsequent application of artificial fertilizers.

As recommended elsewhere, 18 to 20 tons of manure, spread on the soil and thoroughly worked in, is sufficient for the crop the first year, although some growers use as high as forty tons to the acre. By carefully watching the plants, any lack of growth by them can be overcome by applications, on an acre basis, of 100 to 300 pounds of nitrate of soda, 200 to 300 pounds of muriate of potash or 400 to 500 pounds of acid phosphate, or in combination about 300 to 400 pounds of the mixture being used per acre. It is much better to give the plants two or three small doses than one large dose. Nitrogen is a great growth stimulator making the plants rank and green. Caution: Too

much nitrogen may result in excessive growth rather than fruit. Potash will give a stocky, compact growth, and phosphoric acid with potash has a tendency to earliness in production, solidity coupled with quality and colour of the fruit.

If barnyard manure be used as a mulch the first year, during the fall, winter, and early spring, it will be sufficient for the crop in the second year. Of course the major part of the coarse material of the manure, such as long straw, weeds or hay, will be removed in the spring, allowing the finer parts to come into close contact with the moist soil.

Knowing that the preparation period of growth of the strawberry before bearing is but one year, and that getting a large crop of good size and good quality fruits depends upon the acquired strength, growth, and vigour of the plant during this priod, it is highly important that all the surrounding conditions should be of the very best.

This being true, and the fact that stable manure for one reason or another is out of the question, what can be done to obtain a maximum crop of fruit? Many writers advise applications of chemicals without any re-

gard to the condition of the soil, but that is not wise. They would find it out too, if they held the plough or set the plants, or in some other way carried on the practical growing of the fruit.

The condition of the land must be taken into consideration. If it be in a fair state of fertility, as shown by its production of a fair crop of potatoes or corn the season just previous, then fertilizer could be used to advantage. It would not, however, be advisable to plant on land on which for several years fertilizer alone had been used, nor even on renovated pasture land not manured. The best land is that which not more than two or three years previous produced a good sod. This would result in there being humus in the soil, which spells good physical condition of the soil.

With a proper soil chemicals alone can be used, sowing broadcast and harrowing in, just before setting the plants, about 1,500 to 2,000 pounds to the acre of the following mixture:

150 pounds Nitrate of soda 600 pounds Tankage	Nitrogen 2.9%
800 pounds Acid phosphate	Phosphoric acid 9.4%
450 pounds Muriate of potash	Potash 10.7%

or as recommended by the New Hampshire Experiment Station.

100 pounds Nitrate of soda 500 pounds Tankage	Nitrogen 2.5%
1000 pounds Acid phosphate	Phosphoric acid 10%
400 pounds Muriate of potash	Potash 10%

Follow this with an application of a mixture strong in nitrogen and phosphoric acid at the rate of 300 to 500 pounds per acre, applied along the row during the end of June or beginning of July. This application should be made only in case the runners are few or lacking in size. Many growers use two or three applications of nitrate of soda through the summer at the rate of 100 pounds to 150 pounds per acre each time.

In the spring of the second year apply 600 to 1,000 pounds of the first mixture, especially if the plants need stimulation because of winter injury or otherwise. Sometimes 100 to 150 pounds of nitrate is all that is required to increase the size of the fruit. This nitrate is applied at the time of the petals falling, spread in the row.

Do not apply fertilizers when the leaves are wet, nor leave the fertilizer so that it will remain on the leaves, becoming moist, even dis-

solved, during the night, which would result in leaf injury, called burning. A little time spent lightly brushing the leaves in the rows after the application of fertilizer may save many dollars for the grower.

There are many ways by which artificial fertilizer may be applied. The most common being by hand from a pail carried in the crook of the arm. Swing the hand and arm as for sowing seed broadcast, experience being the best teacher, if it is desired to find out just how to apply and how much per acre. Either the one or two horse machine fertilizer spreader does very good work, and can be used if the acreage is so large that hand distributing is impracticable.

CULTIVATION

"Tillage is manure." Although not literally true, it comes very near being so. How great an influence tillage has in the production of large crops of any kind!

Successful strawberry plants cannot be obtained without good tillage, and without good thrifty plants how is it possible to produce large crops of the best berries? Now what is good tillage in strawberry culture?

STRAWBERRIES AS A CATCH CROP

While the young orchard is developing the space between the trees can be profitably given to strawberries

THE NEWLY SET BED

Keep the cultivation going in the home berry patch and you will be surprised at the improved strength and growth of the plants

We have learned that the roots of strawberries are not very large nor numerous, that they do not extend far into the soil, but are relatively surface feeders. It would therefore be advisable to cultivate shallow so as not to injure these tender roots.

It is also known that the plant in its growth uses large amounts of water to dissolve the food in the soil. This then is taken in by the roots and finally passed off in the air by the process of transpiration of the leaves. Each pound of dry material of the plant would then be obtained at the expense of many pounds of water. From this fact conservation of moisture in the soil is very important. This may be accomplished by cultivating thoroughly the entire surface of the soil, leaving a dust blanket to stop the evaporation of water from the soil.

Another point of interest in cultivation is the mechanical effect of grinding the soil, thereby breaking it up into smaller pieces. This may be easily understood when we consider how nature breaks up the larger rocks by the action of rubbing one on the other in the many streams or bodies of water,

reducing them finally to very small particles. These small pieces again are found to be more easily dissolved or some part of them in the soil water, thereby increasing the available plant food of the soil.

In a very dry summer good tillage, with its blanket soil-mulch, conserves moisture, thereby helping to counterbalance the great evil of drought, resulting year after year in more even crops.

Cultivation also offers more opportunity for rains to enter the soil, owing to the more open texture of the soil, and if tillage is practised very soon after the rain the soil crust will be broken, and the moisture conserved. It is, however, highly important that the tillage be level, as there is less soil exposed, therefore less drying out

These are not the only benefits of tillage; large quantities of weeds are destroyed annually by good cultivation. It is quite easy to control weeds if work is begun before they are more than an inch or two high, as the roots of the weeds are shallow at this stage and the growth tender. If the weeds are allowed to grow for some little time, competition between them and the

strawberry plants is so great that the latter suffer by being robbed of sunlight, space, and food.

Weeds are a godsend to man, as they compel him to cultivate his land, thereby helping him to harvest larger crops.

TOOLS

The one-horse eleven-toothed cultivator, the teeth of which are small, is one of the best tools to use in cultivating the strawberry bed. By its lever to regulate the depth the teeth can be run quite shallow, and with the other lever, the machine can be opened or made narrower to suit the convenience of the operator. Its leaving the bed so level, the soil so fine, and its ability to run quite close to the plant without injury or covering are some of the chief advantages of this machine. If the grower uses the hand hoe in the rows of plants, the bed can be kept in the very best of tilth with these two tools alone.

For small beds, or for very narrow rows such as are formed when planting by the hill system, a man power wheel-hoe or cultivator like the Planet, Jr., Iron Age, Columbia etc., which sells for about $4.50, is very

advisable. This small machine does very good work and is a great labour saver.

There are many other tools for cultivation, such as riding cultivators, walking cultivators, many hoes, etc., but for the very best work the ones previously mentioned, from the practical side are superior, because they (1) are easy working tools, of light draft; (2) can be used very close to plants without injury; (3) leave the soil level and in fine particles, making the best dust blanket; (4) are shallow cultivating tools.

HOW OFTEN TO CULTIVATE?

Many rules or suggestions are given in answer to the question. How often to cultivate? It would seem that the frequency of cultivation would depend on the amount and time of the rainfall. Good advice is: "as soon as possible after every rain."

But what if it does not rain for a long period? It is best in this case to cultivate every ten days or two weeks, as the mechanical influence on the soil as well as the making sure that the mulch is working properly will help to offset the expense of cultivation. Continue this cultivation from the earliest

possible moment in the case of new beds, up to the close of the season in the fall, as it is important to keep the plants growing.

In the case of old beds, cultivation begins *after* fruiting and continues through the remainder of the season.

CUTTING RUNNERS

Runners have to be cut in many of the systems of management. This is done with a sharp hoe, spud, wheeled disk runner cutter, or some other sharp tool. The tool used depending upon the labour or time which can be devoted to this work.

It is necessary to go over the beds where runners are to be cut every few days and all surplus runners removed. The less growth the runners make before being cut off, the less food, water, etc., they take from the mother plant, giving the latter plant more opportunity for increased development of itself.

IRRIGATION

A careful search into the history of the agriculture of various countries of the world shows that irrigation is and has been

carried on to a great extent in the growing and maturing of many crops.

Some of the methods used by these various countries would be called crude by Americans, but we find even so that the systems were very practical under their conditions.

What are some of the reasons why irrigation is so important?

1. Water gives more than half of the materials which make up the dry matter of plants.

2. Water constitutes from 50 to 90 per cent. of the weight of plants in their green stage.

3. Soil organisms depend for their normal activity on the correct amount of soil moistures; otherwise they do not work so fast.

4. Root hairs only absorb moisture through the soil. In this moisture is dissolved plant-food, therefore without moisture there is no absorption, resulting in lack of growth and death.

5. With a lack of rain in the spring, fertilizer is of little avail, owing to being not dissolved; irrigation makes this fertilizer available.

After these reasons are carefully taken into

consideration, it is seen that lack of moisture at the proper time is very detrimental to plant growth.

What help can we expect from tillage to overcome these conditions? As to adding water to the soil by careful tillage, it has not been demonstrated that it is possible to do so. Tillage's main help is in retaining in the soil water which falls as rain, holding it there until the roots of the plant take it up. Tillage cannot in any way reduce the amount of water, which is lost by the process of transpiration through the plant. It cannot be expected that the largest crops will grow without water, or that tillage alone can take the place of water. With sufficient water in the soil, it is possible, by good tillage, to obtain the heaviest crops nevertheless. If there is a deficiency of rain, nothing short of irrigation will produce a large crop.

It has been mentioned that the strawberry is a very shallow feeder, and from this it is very easy to see that in droughty springs or summers, if the plants are not irrigated, the resultant crop will suffer greatly. This fact has been quite well brought out by ex-

periments conducted by Professor Goff of Wisconsin:

In 1894, irrigated acre yield was 214.6 bushels; in 1895 irrigated acre yield was 279.9 bushels; mean yield, 243.8 bushels.

In 1894 the non-irrigated yield was 109.3 bushels; in 1895 the non-irrigated yield was 32.3 bushels; mean yield, 70.8 bushels.

This showed a difference in their mean yield of 173 bushels in favour of the irrigated patch. Not only was there a larger yield, but the quality of the fruit was improved, and the berry being larger was more salable.

When irrigation is to be practised there are several points which determine how much water should be applied at each time.

1. How dry the soil is. The drier the soil the more water is needed to thoroughly moisten it.

2. Whether or not the soil is leachy, or otherwise unable to conserve water. Leachy soil requires irrigation more often.

3. Whether or not the feeding surface for the roots is shallow or deep. The deeper and the finer the soil texture the more moisture it is capable of holding.

4. The amount and rate of the movement

of soil water called "capillarity." If there is a good definite movement of sufficient water from the subsoil to the topsoil, irrigation is not necessary.

5. The amount of loss by evaporation of the water from the soil and the rate of loss by transpiration from the crop. The greater the loss in both cases the greater the need for irrigation and vice versa.

In terms of water: if one quarter of a cubic foot of water per second be applied to an acre of ground for about eight hours, it will have covered the surface of this acre to the depth of about two inches. If this application is repeated once in ten days for five irrigations it will be equal to about ten inches of rain in fifty days. This will be quite above the normal rainfall, and from results obtained will fulfil the objects of irrigation.

SYSTEMS OF IRRIGATION

Flooding.—This particular system is very little practised in strawberry culture, but might be advantageously used in extreme cases where a large amount of water was needed at once. It consists of building a bank or furrow around the bed of straw-

berries, causing the water to cover the ground completely, either pumping in the water at some convenient place, or damming up a convenient brook or stream.

Furrows.—It is a very common practice in the West or mid-West to lay out a strawberry field in such a way that water from large main irrigation ditches can be brought on the field and led only in the alternate rows of strawberries (because the rows between must be firm ground for the pickers) in deep, broad furrows, holding the water in these trenches until it has spread considerably in a lateral direction. It is not possible, in these droughty sections, without this or some other method, to place enough water at fruit time within reach of the roots so that irrigation would be unnecessary. The chief objection to this method is the fact that it is not economical of water. This would be quite a factor if the water were bought by the gallon.

Sub-irrigation. — As its name implies, something below. Where this method is used lines of tile or perforated pipe of varying sizes and lengths are laid below the surface, generally one or more large mains with many smaller laterals, sometimes the mains

being at the edge of the strawberry patch and the laterals laid beneath each matted row of strawberries. More often the main is laid with laterals every ten or twenty feet apart without regard to the crop planted on the soil.

The advantages of this system are:

1. As the water comes from below up it is a great deal like capillarity, sometimes spoken of as an ideal method.

2. Compared to the furrow, it is less expensive, as once installed it will last for years, as it does not require moving of the soil each year.

3. Does away with any obstruction in the field, everything being below ground. Its greatest advantage.

4. Earth mulches once given, are not destroyed by this method.

Following are the disadvantages:

1. Water does not spread laterally from these pipes sufficiently, so it is difficult to give the crop enough water.

2. Owing to above, in order to force water laterally, more water is needed than by the furrow method.

3. Where cost of water is high it would therefore be too expensive.

4. Tile costs about $90 per acre, where they are laid in rows five feet apart, and in good digging not less than $20 per acre is required to lay the same; therefore too expensive.

5. Rains fall from above and soak into the soil, drawing air down into the soil, causing the soil to be aerated. Sub-irrigation lessens this process as the water does not draw so much air into the soil.

Overhead system.—To date, this may be called the best system as it has many of the advantages of the former methods and more advantages of its own. It is very economical of labour and water, resulting in great savings where these two items are costly.

The Skinner system is typical of this method, and was first used by the inventor in the spring of 1897, and has been in continuous operation since. It was first given to the public in 1904,

The system consists of parallel lines of pipe, in which are inserted especially devised nozzles, located in the pipe at distances approximately four feet apart. The nozzle lines are from forty to sixty feet apart, depending upon the local conditions. The water is

distributed in a manner which insures absolute uniformity, which covers every square inch of the soil, and is under control of the operator. A turning device enables the operator, by one movement, and without leaving the power house, to control the distribution of the water on a large acreage.

Besides giving water for the growing crop it also affords protection against frost. It should be noted, however, that it is practically useless to apply the water after the plant has been frozen or touched with frost. The pipes must be kept moving so that the water is applied on a given place at intervals of not to exceed two minutes' duration. The sprinkling should be begun previous to the frost and continued throughout the night until the temperature rises above the danger point.

It may seem incongruous that a plant can be protected from the frost and at the same time be covered with ice, but this is nevertheless true. Water in freezing parts with as much heat as in dropping from 112 to 32 degrees. With the Skinner system, in seven hours and with a pressure of thirty pounds, there can be applied on a ten-acre plot one

and one half tons of water every minute. This furnishes abundant protection.

Uniformity of distribution is also gained, which is second only in importance to the requirement of applying water. The soil can be watered to any degree of dampness without any uncertainty or irregularity.

It has been the common belief that water upon the foliage of the plant is injurious to it, both because of a possible tendency to fungous growth and also because of the action of the sun's rays. This is contrary to the fact that the most luxuriant foliage is to be found in the hot, moisture-laden atmosphere of the torrid zone.

Exhaustive experiments have proved the common belief to be in error and have shown that the tendency to fungous growth is due, not to the application of water on the foliage, but to the bruised condition and injured texture of the plant, caused by improper application of water. They have also proved that the action of the sun is not injurious to the moisture-laden foliage, but that moisture on the surface of the soil will, under the sun's rays, injure the growth.

The cost of installation of this system is

less than that of any other irrigation system, which might be considered. The cost of a field equipment varies with each particular installation, ranging from $90 to $150 per acre; however, the usual cost for this equipment lies between $100 and $125 per acre. This figure does not include the pumping plant, the cost of which, together with the cost of the mains leading to the field, should be added.

The investment is permanent, and the life of the system is limited only by the life of the pipe used to conduct the water. Owing to the fact that this system can be operated with less pressure and with less water waste than any other known system of this form of irrigation, the cost of installing a pumping plant is reduced to a minimum. It may be added also that fertilizers and fungicides in solution may also be distributed through these pipes under certain circumstances.

CHAPTER V

Insects, Diseases, and Spraying

Several years ago spraying was not considered necessary for the production of a large crop of good quality, but with the increase in the acreage and the multiplication of varieties, the insects and diseases have become so troublesome that in very many places where strawberries are grown it is highly important that spraying and other advanced methods should be carried on in order to grow this crop successfully.

With the demand for knowledge concerning these insects and diseases among the growers, more and closer study of this valuable fruit has been forced on experimenters and students throughout the country, as well as upon the manufacturers of spraying machines who try somewhat to cater to the needs of the growers and students. There is, however, room for improvement along these lines.

The most important thing to know before spraying is, what we are spraying for. To this end it is necessary to have some idea of the many enemies, both insects and fungi, which prey upon the strawberry.

It is, however, quite important that spraying begin quite early and continue as long as needed throughout the season. It is easier to check or control enemies when they first begin to be troublesome in the early spring than it is to try to overcome or subdue them after they have become established. In fact, with some insects and diseases it is very hard work, if not next to impossible, to do much to stop their ravages after once they have a good start. The more important pests are described below:

INSECTS

Root eaters. — There are at least three species of beetle which in the larval or grub stage live in the ground and feed upon the fibrous roots of the strawberry plants. As their life history and description are so nearly alike, they can all be called white grubs or June bug larvæ. These grubs are so

common throughout the United States that they need no introduction. They are particularly abundant in grasslands, both meadows and pastures, owing to the fact that their principal food is the roots of grass, weeds, and herbs. These insects destroy practically every strawberry plant almost as soon as it is set, if sod ground is used for growing strawberries.

When the grubs have become full-grown, they have a rest period or pupal stage in which they encase themselves in earthen cells in the soil. After a certain lapse of time they come out as small beetles and feed upon the foliage of the plants, sometimes doing considerable damage.

The remedy for the insects in the larval stage is to fall plough sod land, following this by one or more years of crops that require good tillage. In the case of the strawberry beds being affected, it would be very difficult to deal with the grubs on account of their underground habits. If badly affected it would be better to plough up. Breeding grounds, such as old strawberry beds, should not be allowed to remain.

Crown eaters.— Several different insects

attack the crown of the strawberry, the crown miner being one of the more important. This is a small, reddish caterpillar that constructs or bores irregular passages through the crowns of the plants. No successful remedy has thus far been brought forth. Fields badly infested should be ploughed up.

Another crown borer is the common white, footless, yellow-headed grub, so destructive in the strawberry fields of the Mississippi Valley, and the mid-West. The eggs are laid in the spring in the crowns of the plants. Soon after hatching the small worm or larva eats its way into the crown, hollowing out from one third to one half of the crown during the summer, or until the grub gets its growth. If more than one larva is excavating the same crown the plant is practically killed by their work. The rest stage is carried on in the cavity of the crown and the final change to a mature, small, dark-coloured snout-beetle is brought about in the same place. The adults come out in the autumn, feeding upon the plants and wintering not far from where they were hatched, as they are unable to fly. Egg laying begins early in the spring.

Owing to the rudimentary condition of the wings of this insect, it does not pass rapidly from one field to another, so trouble from this source would be considerably modified by a good system of rotation. If plants are to be taken from old beds they should be removed before the insect lays its eggs. Spraying in the fall with arsenates will result in the destruction of many of the beetles. The burning over of old beds after picking the crop is very beneficial in destroying great numbers of these insects.

Leaf eaters.— The most injurious insect of the strawberry is the leaf roller. This is a small, brownish caterpillar that folds one of the sections of the leaf of the strawberry by fastening the upper surfaces together with very fine silken threads, feeding upon the enclosed surface until the leaf turns brown. When the larva is full-grown it is about half an inch long. It then pupates, or rests, inside the rolled leaf, emerging as a moth in midsummer, being in turn able to lay eggs for a second brood of caterpillars, even three or four broods a year being hatched in the Southern States.

The remedies are simple, consisting of

ROOTING RUNNERS IN POTS

These plants will be ready for their new beds in August

POTTED PLANTS

A well-rooted plant from a pot may be set out in August and a fair crop gathered the next spring. On the right is shown how to pot: good drainage, and the soil made firm enough to stand alone

mowing and drying of the leaves after fruiting, followed by burning for the early brood. For the late broods applications of arsenical poison can be used, thus destroying many of the insects.

Another leaf eater is the slug. This insect appears in the spring as a four-winged fly, depositing its eggs within the tissue of the leaves or stem. Shortly after the eggs hatch; and the larva or worm eats small round holes through the leaves, until in five or six weeks it develops into a pale green worm nearly three fourths of an inch in length. Just previous to the rest stage it enters beneath the surface of the leaf, forming a cocoon in which it rests, coming out later as a fly. In the North one brood a year is common, two or more being usual for the warmer climates of the Southern States.

Arsenical poisons, sprayed on the foliage of the plants, will hold the insect in check. If the plants are in fruit, non-poisonous insect powders like pyrethrum or hellebore must be used. After fruiting burning the bed over after mowing the leaves will check this insect.

Fruit-injuring insects. — A small, black

snout-beetle, "which lays its eggs in the buds of the strawberries, following this by eating away the part of the stem below the bud, causing it to droop," known as the strawberry weevil is one of the most injurious insects of the fruit. A little white grub, which develops from the egg in the bud, becomes fully developed in a few weeks. About five weeks after the egg is laid it emerges from the pupal stage as a perfect beetle ready to begin work on other flowers.

Clean culture is very necessary in combating this insect, especially with reference to neighbouring old strawberry or blackberry beds. As these latter are insect-breeding beds they should be destroyed. Applications of insecticides are not of value, as the insect feeds inside the bud.

Covering the beds, if the plantation is small, will prevent entrance of the insect. The commercial grower must depend on rotation of crops, clean culture and ploughing or burning over badly affected beds.

Many times malformed fruit is found which is known as "buttoning." This is caused by the check in the growth of the young fruit given by the tarnished plant

bug which sucks the sap from the fruit. Eggs are laid early in the spring, the young hatching very soon, about the first of May, feeding with the parents on the host. During July the winged insects scatter and are found on a great variety of plants.

Application of pyrethrum powder has proved to be the best remedy so far. Contact sprays, like kerosene emulsion, are also useful. Poisons are useless as the insects do not chew their food, but suck it out of the plant tissues.

The red spider is the bothersome pest in the greenhouse. It may be controlled somewhat by syringing the foliage every pleasant day and by wetting down the walks, making a moist atmosphere in the house.

Fungous diseases. — The most important fungous disease is a leaf spot. This makes its appearance in the form of small, discoloured spots, being most abundant about the time of flowering. At first these spots are of a reddish or purplish tint, a little later increasing in size, resulting in the death of the tissue and a change in colour to white in the centre bordered by red or purple at the edges of the spots. Practically all strawberries are sus-

ceptible to this disease, although some varieties, are more resistant than others, especially Marshall and Brandywine, while Bederwood has great susceptibility.

The remedy is bordeaux mixture sprayed on just before the flowers open, followed (if the disease is seriously prevalent) by mowing off and burning the leaves after the fruiting season is over. On small beds the diseased leaves may be removed by hand.

These remedial measures will also control the other less important ones, which need not be discussed in detail.

SPRAYING MIXTURES

Commercial growers have become quite familiar with the preparation of bordeaux mixture, but for the benefit of those who are growing plants on a smaller scale this account of the mixing is given.

I believe in being on the safe side in the preparation of a spraying mixture, believing that a few pennies spent at this time may in the end save many dollars. The standard formula is:

4 pounds Copper sulphate
6 pounds Lime
50 gallons Water.

To prepare: place the copper sulphate in a bag, suspended in a barrel or other wooden receptacle holding four gallons of water. In another barrel slake or mix six pounds of lime with six gallons of water. When time to spray, take the solution of copper sulphate and pour into the spray barrel, add forty gallons of clean water, then strain in the six gallons of the lime water (milk of lime as it is sometimes called). The extra lime will counteract possible injury from excess strength of the copper sulphate. This is a fungicide.

The addition to this mixture of three pounds of arsenate of lead, for leaf-eating insects, makes a good all-purpose spray mixture.

In the cases where the fruit is set and there is danger from poisoning if any of the arsenic forms are used, hellebore or pyrethrum powders, both being non-poisonous, may be employed. Apply these powders early in the morning with the dew still on the leaves, either using a bellows sprayer or better still the powder hammer, which is nothing more than a large, cheaply constructed shaker attached to a short handle.

The powder being placed in this shaker, the operator raises the shaker, dropping the same as if hammering, catching it in the other hand at the most convenient distance for thorough spraying of the powder on the leaves.

Kerosene emulsion is recommended against the tarnished plant bug. Poison cannot be used as the insect belongs to the sucking class.

The preparation of kerosene emulsion is: take one half pound of good laundry or whale-oil soap, dissolve in one gallon of hot water, after which add two gallons of kerosene, agitate violently until there is an emulsion-like fluid. To use, dilute one part to fifteen parts water.

For the home gardener various manufactured spray mixtures may be much more convenient. These are fully efficient, and should be used according to directions.

Kerosene emulsion, bordeaux mixture, and all other spray materials which are in a liquid form are best applied with a force pump which is powerful enough to push the spray out in a very fine mist. For the home garden or small patches one of the small compressed

air sprayers, costing about $6, complete, will be very satisfactory. They have a sling and are carried under the arm. The capacity is about two gallons of liquid. The knapsack sprayer, which is carried on the back as its name implies, is also quite a good one, but has not the high pressure of the former.

For field work the size of sprayer would depend on the acreage planted, the kind of sprayer would depend on the man's likes and dislikes and the amount of money he has to invest. For small fields where the grower is just starting in, and wishes to, or has to, practise economy, a barrel pump, mounted in a good oil barrel, with the necessary hose, nozzles, piping, etc., is a very practical outfit.

A man with some mechanical ability can arrange with gas pipe a four-rowed sprayer, mounting the complete outfit on a two-wheeled rig, having the wheels so that they spread two rows of plants, the horse walking in the middle cultivated strip. With a good horse, one man can pump and drive.

For larger fields some of the much advertised spray rigs with all their equipment are advisable. Some of these sprayers have

gasolene engines for pumping and spray five or six rows at a time. The liquid with these machines being under pressure of 100 to 150 pounds, is forced out in a very light misty spray, covering all parts of the plants very completely.

CHAPTER VI

Picking, Packing, and Marketing

The strawberry demands a great deal of care at picking time. When the berries have come to their large green stage and begin to turn to the pink, then scarlet or red, it is very important that careful attention be given, and that the picking begins at the right time, subsequent pickings being given either every day or every other day, according to the condition of the bed, etc.

Picking is a quite simple process where the patch is a small home one or really part of the farmer's garden, in which the owner picks according to the demands of his household, but where the business is on a commercial scale it is indeed a problem.

The grower must depend for his pickers upon the women, girls, and children in the community, attracting them either by a slight increase of price per box for picking,

constancy of yearly pickings, or by larger yields of berries, making it easier or quicker to earn a good day's pay.

Oftentimes the pickers come asking for this line of work; other times the grower may obtain the pickers by an advertisement in the local paper or a notice posted on the farm bulletin board, which in many farms is located near the boundary road.

A FEW RULES FOR PICKING

The grower must have a few general rules for picking, such as:

1. Berries must not be picked while there is moisture on the vines.

2. Berries must be pink all over or three fourths red.

3. Berries should be picked riper in cool weather than in warm.

4. Berries should be picked riper for local trade than for shipping.

5. Filled carriers must not be allowed to stand in the sun.

6. Berries must be picked with stem at least a quarter of an inch long, but not longer than one half an inch.

After the pickers have been selected, it

is necessary to firmly fix in their minds several very important points.

These are called the pickers' rules:

1. That each picker shall have a certain space or row allotted from which he or she is to pick all berries of a certain stage of ripeness; each picker being responsible for this space or row.

2. When removing the berries from the vines, pick them by pinching or breaking off the stem from one fourth to one half an inch above the berry. Carefully place in the box each berry with its hull and part of stem attached.

3. Do not squash or press the fruit with the hands.

4. Do not walk or sit in the plant row.

5. Grade the berries as they are picked.

6. Don't talk too much, run about bed, or create a disturbance.

By careful enforcement of these rules it is possible to pick the fruit cleanly, have it graded at the least expense, and obtain the best possible fruit without having mashed or soft berries.

As the pickers gather the berries, they must place the same in some convenient

receptacle, the split-wood strawberry box, holding about a quart, being the most commonly used. Each picker should have four or six of these boxes, and for convenience in carrying them should have a picking stand. This stand can be home-made, consisting of a tray of sufficient size to hold the number of boxes required, mounted on four short legs, holding the tray off the ground, to prevent injury to the fruit or the plants and doing away with spilling of the boxes gathered.

A handle of either part of a barrel hoop, or heavy wire, firmly attached to the sides of the tray for convenience in carrying, is also valuable. With one of these trays and six boxes, the pickers can grade the berries into three or more classes:

First grade: extra large selected berries; Second grade: medium size berries; Third grade: culls. If the pickers are careful in this matter of grading and picking with hulls attached to berries, the boxes can be placed from the pickers' trays into the crates for shipment.

As each picker brings in his full boxes of strawberries, it is highly important that

some form of bookkeeping should be carried out so that each worker will receive full credit for the number of boxes picked. The system of a tallyman, who has each picker's name, and marks against these names the number of boxes picked, has not proved satisfactory, because of the lack of confidence in the tallyman by the pickers.

The method of giving checks which have numbers from one to ten on them, denoting the number of boxes received, has proved quite satisfactory. These checks can be again exchanged for checks of higher denomination as 20, 30, 40, 50, etc. The great advantage of this method is that each one of the pickers keeps his own books and is paid according to the amount of checks turned in on the day of settling accounts. Pickers, however, are liable to lose the checks which causes some misunderstanding at times.

Tags which have numbers from 1 to 50 printed on them, which are punched as the picker turns in the full boxes, are found to be the best system to date.

Pickers are generally paid by the box, and the more experienced the worker, the larger the income. Some sections pay one cent

a box for picking strawberries, other places pay two cents, and in a great many districts one and one half cents is paid. From carefully worked out figures the latter amount is the average price for picking in the many strawberry sections. Pay day comes at the end of the season as a rule, as the pickers are retained better by paying but once; or, if paid weekly, one quarter to one half the pay is retained.

The average picker, in my experience, will pick from thirty to forty quarts in the morning—that is, from 9 to 12 o'clock. One report from New Hampshire states that a young woman of sixteen picked one hundred quarts in six hours.

PACKING

As the full boxes are brought from the field, they are given to the packers. The packers should not be in the full sunlight, but in the shade of a tree, under a tent or temporary building, or in a permanent building. The strawberries when received should be placed in a cool room where the temperature can be held at 50 degrees, or, in case this is not possible, they should be

placed in the shade and in the coolest spot available. The packers then take the boxes as they need them, emptying the fruit on small trays or tables three feet wide and four to six feet long.

All imperfect and defective specimens are then removed, the remainder being sorted as to size and sometimes colour, placing them in the boxes, the top layer of fruits being arranged evenly, hulls all one way down, making the full boxes very attractive. These layers may be arranged in tiers 4 x 4, 4 x 5, and 5 x 5, according to size.

The full, well-packed boxes are then placed in crates. The thirty-two-box crate has eight boxes on the bottom layer, then a slat form on top. This protects the layer and serves as a foundation for the next layer. Four layers of eight boxes each constitute the standard crate, except in the case of the refrigerator crate. One good packer will sort and pack from fifteen to twenty crates a day at a cost of from 15 cents to 25 cents per crate.

RULES FOR PACKING

1. No culls in the boxes. Put nothing but fair-sized fruit, none under five tier.

2. After filling box about half full place the rest stems down, in order that the top layer may be placed evenly and level, stems down.

3. Fill boxes solid, especially at corners, or they will be short weight, settle, spoil your pack and bring less money.

4. Fill box so that top of layer will come three eighths of an inch above the top of box.

5. Allow no berries to project over side of box, if they do berries will be crushed, the pack spoiled and the box stained.

6. Packers to sort out all green, overripe, misshapen and under five tier berries.

7. Use clean crates and keep them from being soiled.

8. After crates are packed, place them in a cool place.

SHIPPING

In the case of fruits to be shipped long distances, it is advisable to cool the boxes of berries for one half to three quarters of an hour before they are placed in the refrigerator cars. This cooling and subsequent placing these crates in refrigerator cars hardens off the fruit, preventing to a considerable

FORCED STRAWBERRIES

Around Christmas time there is a limited demand for fine forced berries which sell at prices ranging from $1.50 to $8.00 a quart

THE TIME TO MULCH

This is done to conserve moisture and to keep the berries clean. Salt hay, grass clippings, or pine needles are often used

extent the ripening of the berries while in transit, delivering the fruit at the market in much better condition than if not cooled.

The grower is enabled by this process to bring his fruit to a riper condition before shipping. Care must, however, be exercised not to overdo the cooling nor to hold the fruit in cold storage too long, as it is not possible to do so profitably. This method is expensive and demands a higher price for the product, the demand though is quite brisk in the larger markets for the early berries at good prices.

Local or nearby markets do not demand the former expensive method. Cool the berries before taking them to the market or depot, carry the crates in a spring wagon, with a canvas or some other cover over the berries to keep out the dust. Leave the crates in a cool, shady place, having them at the depot but a short time before the train is due. Notify the person you ship to, be he commission man, grocer, or individual, of the shipment, number of crates or boxes, time of shipment and other matters.

Having the grower's name on the crate,

or better still on every box, with the farm's name and address, supplementing an even supply of good berries, well packed, honest all through, and sending the same to individuals or reliable commission houses, will result in the building up of a lasting, paying trade for the grower.

INCIDENTALS NEEDED FOR PICKING, PACKING, AND MARKETING

The grower needs the following articles for the successful handling of his crop of fruit.

1. Split-wood, one-quart baskets, such as the Berlin, Hallock, Leslie, etc. The Berlin is the most common, being a white box, made from basswood, which adds to the attractiveness of the fruit. This box is 5 inches square on top and $4\frac{1}{2}$ inches square on bottom, being from $2\frac{3}{4}$ to 3 inches deep, and holding about $67\frac{1}{2}$ cubic inches.

The Hallock (Michigan) box is made in two sizes, No. 1 or wine measure, is $4\frac{1}{2}$ inches square, 3 inches deep and $3\frac{7}{8}$ inches high outside, and contains $60\frac{3}{4}$ cubic inches. No. 2, or full quart, is $4\frac{3}{4}$ inches square and the

same depth as No. 1, and contains 67¾ cubic inches.

The Hallock (Illinois) box is 5 inches square and 2½ inches deep, containing 62½ cubic inches.

The Leslie, standard box of the South, generally sold in the flat is made up by wrapping the band around the bottom, inserting the corners of bottom in punch holes of band and driving the tacks or staples through the lap of the band.

The "wine measure" box has a band 3¼ inches wide and 20¼ inches long, and the bottom is 3¼ inches in width and 6¾ inches long. The band for the "dry measure" is 21¾ inches long and 3⅜ inches wide and the bottom is 3½ x 7⅛ inches, the box being 2¾ inches deep inside, and holds a full quart, 67¼ cubic inches.

The cost of those boxes per thousand is: Berlin, $3.50; Michigan Hallock, $3 in the flat; Illinois Hallock, $3 in the flat; Leslie, $3 in the flat.

There is a law in some states as to the size of boxes for strawberries. It would be well for the strawberry grower to look

up this matter, especially in the state to which he intends to ship fruit.

2. Crates are necessary so that these boxes may be sent to market in a sealed receptacle.

For the Berlin boxes a crate holding thirty-two or twenty-four quarts is used. The gift crate made of light slats with heavier bottoms and tops and having three racks to place between layers of boxes is very economical and desirable. The thirty-two-quart size costs $8 for fifty and the twenty-four-quart size costs $7.50 for fifty. For those growers who peddle their fruit or sell it so that the crates are returned, a more durable crate, iron bound, costing thirty-two-quart size, fifty for $23.15, and twenty-four-quart size, fifty for $19.90 is recommended.

For the Michigan Hallock boxes, a sixteen-quart and twenty-four-quart size is made, the smaller size weighing about three pounds and the larger five pounds. This is quite light for the strength of the crate. One hundred of the sixteen-quart size cost $6.50; one hundred of the twenty-four-quart size cost $8.

This is exceedingly inexpensive for shipping crates and can be used as gifts without overburdening the grower with excessive expenses for marketing.

The Leslie crates are also very inexpensive, costing but $7 for one hundred of the twenty-four-quart in the flat. For the full quart boxes the crates have three heads $7\frac{1}{4}$ x $14\frac{3}{4}$, two pieces for covers $7\frac{1}{2}$ x $23\frac{1}{2}$, two pieces for sides $6\frac{1}{2}$ x $23\frac{1}{2}$, and three pieces for bottoms 4 x $23\frac{1}{2}$ inches, weighing about six pounds. The wine measure differs somewhat in size, owing to their being small boxes, but they are made up the same way.

Refrigerator crates for distant shipping are sometimes used; these are heavy crates which give an opportunity for cooling or chilling the fruit, generally by placing ice in the bottom of the crate and closing it somewhat tightly.

3. Picking stands, one for each picker, either home-made or purchased, are very convenient for the quick picking and carrying of the fruit in more than one basket. They are made to carry either four, six or eight quart baskets and are equipped with a handle. Legs on them are also useful.

Four-basket size, twelve for 60 cents; six-basket size, twelve for 75 cents; eight-basket size twelve for 75 cents.

4. Checks, tags, or some good system of tallying boxes picked by the pickers is essential.

Tags should have blank space for writing in the grower's name, picker's name, date issued, and price per quart. When the picker brings the berries into the packing house or shed, the grower or tallyman simply punches out the printed figure corresponding with the number of quarts delivered. Five hundred printed on No. 6 shipping tags cost $2.25; one punch costs 40 cents.

5. Tent, shed, or packing house, containing a sorting table and room for pre-cooling the fruit. This packing place need not be expensive, but can consist of a simple shelter, which will hold off the sun's rays and permit of the cooling of the fruit. The sorting table can be home-made; two wooden horses and some boards, smooth side up, make a practical table.

6. A spring wagon to transport the fruit from the packing shed to the station is

important, as it does not cause the fruit to be joggled and thereby crushed. For a small number of crates, a good farm democrat is a good wagon (cost $60 to $125); for larger loads anything from a one-horse express wagon up to the very expensive market gardeners' wagons can be used.

CHAPTER VII

Mulching, Renovating the Old Bed

In gardening parlance "to mulch" means to cover the surface of the soil with any material, such as leaves, loose earth, hay or straw, so as to protect the roots of the plants from frost, loss of water by evaporation or weed growth, etc. As used in the sense of mulching strawberries, it will mean the covering of the plants with organic matter, such as dead vines, hay, straw, leaves, etc., in the fall for winter and early spring protection.

MATERIAL USED FOR MULCHING

There is a great variety of materials used for mulching. Nature's mulch is the débris of fallen leaves, grass, and other litter. In the grain-growing sections, wheat, barley, or oat straw is used quite extensively; near marsh land, either salt or fresh, the coarse hay taken from these places is used.

In the East oat or rye straw is generally the material. Many places have quantities of pine needles, seaweed, leaves, evergreen boughs — all these are good. Near large cities, where stable manure is obtained for the hauling or at a low cost, it also is used for mulching. The list is so long that it would be nearly impossible to enumerate all the materials that could be used. Enough to say that all straws or other litter should not contain large amounts of weed seed, that the materials should be raised or purchased at a low price, and that the materials should be fit to protect the plants without smothering them.

OBJECTS OF MULCHING

By a careful study of the results of mulching the following objects are brought forth as the reasons why one should mulch:

1. Protection of plants from winter or early spring injury. The excessive cold on bare ground often results in the destruction of the plants. Heaving of the plants in the early spring by honeycomb frost is one of the greatest sources of unthrifty, profitless strawberry beds. These can both be overcome by mulching with the proper materials.

2. Conservation of moisture in the soil by hindering evaporation. From a study of soil cultivation it is found that by breaking up the top layer and leaving it in a fairly loose condition it is possible to reduce to a minimum the loss of moisture by evaporation. This is nothing more than a dirt mulch and stops capillarity, the rise of water in the soil just below the loosened surface. Any material such as has been mentioned will give the same results as the dirt mulch, and has the further advantage of being more permanent, not being destroyed, as is the dirt mulch, by the first rain.

3. Retaining the surface soil in a loose, friable condition. This is brought about by the fact that the soil is not packed down by being tramped upon or by heavy rains beating upon it, but is retained in the same condition as it was just previous to being covered with the mulch material.

4. In some cases plant food is added to the soil. This is particularly so when manure is used as a mulch, principally by the washing of the plant foods out of the manure into the soil.

5. Cooler soil, the direct results of the

shading of the soil and the liberal supply of moisture in the topsoil, making root growth; in colder regions retarding growth until all danger from frost is past.

6. Lessens weed growth by smothering the young seedlings.

7. Where some of the mulch is left on the bed after plant growth starts in the spring, it holds the fruit up from the soil, thereby enabling the grower to obtain cleaner fruit.

HOW TO APPLY THE MULCH

The easiest and quickest way to apply stable manure, fine chaff, or any other fine material on matted rows of strawberries, after the ground is fairly firmed by freezing in the fall, is with a manure spreader which straddles the rows. Set the spreader to throw fifteen tons to the acre; the plants will be covered just deep enough and very evenly.

All coarse straw, vines, etc., will require hand labour. Stacks of these materials should be made, or loads should be dumped at convenient distances along the sides or ends of the strawberry bed; then men with forks can spread the material over the plants, being careful not to cover them too deeply

nor to injure the plants by careless walking or forking.

WHEN ARE MATERIALS APPLIED?

Where freezing of the soil is light and thawing often follows, it is advisable to apply the mulch just as soon as the active growth of the plant ceases, either in the last of October or the month of November. Protection in this case would not only be against the many freezes and thaws but against the high dry winds of winter, which often do great damage to plants by drying them out or by exposing the roots to later sun action by removing or blowing away the soil.

In the colder parts of the country, where the freezing is more permanent, it is best to wait until the ground is frozen hard enough to allow the wagon or cart to be driven upon it without breaking into the soil. At the extreme North, where snow comes early and stays until late spring, it would be hardly advisable to mulch very heavily as the plants would smother with the combined mulch and snow.

WHEN IS THE MULCH REMOVED?

Where heavy mulching has been practised it is best to remove the coarse, bulky part

quite early in the spring; otherwise the strawberries will have a whitish tender growth which will be injured when exposed to the sun. Where light mulching is carried on, and the plants are pushing their growth through, it is best to remove only patches of mulch that are too thick for rapid plant development.

Some growers remove the mulch just as early as they can, and practise thorough cultivation up to the time that the fruits are half grown, believing that they are thus able to obtain large yields of better quality fruit. If the mulch seems to be needed they replace it in order that the fruit may be held up from the soil.

The chief drawback to this method is the greater chance of the fruit being gritty by being spattered with the loose soil if rain should fall during the last stages of fruiting.

RENEWING OLD BEDS

The lack of sufficient knowledge on the subject of renewing old strawberry beds has caused many growers to go out of the business in despair and pronounce this industry an unprofitable one. This question of just

how often a strawberry plantation should be renewed is one of the most disputed, different growers advancing contrary ideas with equal evidence in each case.

In the majority of cases of failure the people have not learned that the strawberry is not a plant that can bear a profitable crop indefinitely, but must be renewed, unlike other fruits such as the apple, pear, etc., which bear crops for long periods.

Two, or in some cases even three, profitable crops of fruit may be harvested before it is advisable to plough under the old bed. The advisability of removing more than one crop depends largely on the condition of the patch. If there are not too many weeds in the strawberry bed and the plants are numerous, showing considerable vigour and healthy foliage, it may be left for a second or even a third crop.

The older beds are more liable to serious attacks of insects and diseases which slightly increases the expense of management because more frequent applications of spraying materials are necessary.

Another point in the holding over of the beds, and not in their favour, is the decrease

in size of the fruit; but this is practically made up for in the early ripening of the fruit, enabling the grower to ship his berries earlier to market and thereby obtain some of the higher prices.

If a bed is to be carried over for two or three years, it will be found that the increased cost of weeding or cleaning out the old bed is greater than that of setting out and caring for a new one.

There are at least three methods by which a strawberry bed may be renewed with very satisfactory results. All of these methods rquire, however, a bed filled with numerous thrifty and vigorous plants.

The first method, used after the plants have fruited, consists of ploughing one furrow from each side of the matted row, leaving a strip in the middle not more than a foot wide, which has a fair number of good plants growing in it. Following this, well decomposed manure is spread liberally on the hill, or back furrow, which the ploughing has made between the plant rows. At least 15 tons to the acre should be applied, and more if it is available. The shovel-tooth cultivator, either five or seven teeth, should then be

used in this ploughed strip. This will mix the soil and manure and should level off the freshly ploughed strip between the rows. At this time, or just before cultivating, it is a good practice to go through the patch with a hoe and cut out the old plants. If it is not possible to tell the difference between old and young plants, the rows of plants can be cut so that six or eight inches of soil with three or four plants growing in it are left in the row, then a cleared strip of six or eight inches, then another collection of three or four plants, and so on.

If the soil throughout the bed is made level, the remaining plants will soon send out runners and at the joints new plants will form. Very soon an entirely new bed will be obtained, and where cultivation and care are given the results will be quite satisfactory.

The second method which is started at the same time as the first — that is, after fruiting — consists of ploughing only on one side of the matted row. Generally two furrows are necessary, but in very wide rows three or four may have to be given.

By this method the original plants, sometimes called the mother plants, are ploughed

under and the remaining plants are all young plants. These young plants are left in a long row or strip which should not be over one foot in width, nine inches being better. A heavy coating of manure as used in the first method is applied and worked in with the cultivator, leaving the bed level. None of the plants in the row are cut out, but are allowed to produce new plants as desired by the grower.

It is seen by this second method that the major part of the new plants will have new soil to grow in, as the centre of the matted rows will be changed at least one foot in one or the other direction.

The third method is that of pot-growing the plants, replanting in the fall from these pot-grown plants and ploughing under the old bed. This may be done by two systems:

First: Quite early in the spring the very best, extra choice, large plants are selected for planting. These are set in soil that is as near as possible the ideal for the most successful strawberry production. Each plant is allowed to make not more than four runners; two are better. Only one plant is allowed on each runner.

Second: Plants are selected in the old bed, generally those that have marked ability as to productiveness and heathfulness. This system is quite similar to the first method, but saves time and labour as the plants are not transplanted. The same afterwork for both systems follows:

Underneath the joint of the runner, where the new plant will be formed, three or four inch pots, filled with good soil, are buried to the rim and a little soil is placed on the runner, both to keep it in place and to help start the new plant. After the leaves have formed and the roots have developed so that the plant may be independent of the parent, the runner is severed and the pot is either taken to a coldframe or it is placed where good care, and especially water, can be given. Sometimes it is either planted in the fall or directly in the bed after the old bed is turned under, where it is allowed to produce fruit the next spring. Other times it is carried along in the pot for winter forcing in the greenhouse as is later described.

For methods one and two, provided manure is not available, 800 to 1,000 pounds of any of the complete artificial fertilizers can be

broadcasted and cultivated in, followed by such light applications of fertilizer as, in the estimation of the grower, may be needed.

There is one practice that should be carried out, especially on mulched beds that are about to be renewed, and that is the use of the mowing machine just after fruiting. Run the machine with the bar set high so that it will cut the old leaves but not injure the crowns. Allow the leaves to dry for a day or two, then start a fire at the windward side and burn the bed. If the fire burns down the length of the row, it will be better than if it burned across the rows.

Be careful that there are no large masses of mulch on the bed, especially over the plants. Sometimes it is advisable to rake the rows and burn the raked material in the cultivated strips.

The advantages of burning are:

1. That the bed is left clean.

2. That insects or diseases are killed or controlled.

3. That the bed, being clean, is easier to work.

After one or the other of these methods is used, the bed is treated just the same as if it

were a newly set patch. In fact, the whole idea in this renewing is nothing more than the saving of the cost of setting a new bed or saving the hand work where good labour is scarce.

Generally, a grower will practise rotation of crops, taking but one crop from his bed and setting out another on an entirely new piece of land; believing that what little saving there may be in renewing the old bed will be greatly counterbalanced by the larger size of fruit, freedom from insects and diseases, and better physical and chemical conditions of his soil.

CHAPTER VIII

Winter Forcing

Thus far in the United States the forcing of strawberries for a winter crop has not become commercially of any great importance. But it is possible to obtain an extra or fancy price for ripe strawberries in midwinter or even a month or two before the influx of the out-of-door fruit.

This trade earns a price that is even in advance of that received for the fresh fruits shipped from the South, and competing in the same market with them. On many of the large estates, or even small places, where suitable arrangements are made for growing the plants in greenhouses, strawberries are produced more for the benefit of the owners in having an out-of-season product than for their mere money value.

Strawberries can be forced to fruiting without much difficulty, provided a person

has a good greenhouse or some glass or semi-glass structure in which a certain temperature can be maintained. The old idea that the plants must be placed near the glass or they will be drawn out — that is, become slender — is not so true to-day with our modern large pane, non-light obstructing constructions, giving to the house the greatest amount of light possible. However, with a heavy sash bar or sash house having small panes of glass, the roof should be low and the plants near the glass.

The best variety for forcing is the Marshall. It seems that this berry is particularly adapted to the most intensive forms of strawberry growing, and especially as an out-of-season production in the greenhouse.

The two methods of growing the plants are on benches and in pots.

The former method is used but little, while the latter is employed for the following reasons:

1. The roots are enclosed in each pot.

2. It is possible to control plant food, such as liquid manure or fertilizer.

3. By controlling the food, each demand of the plant can be catered to.

FORCING IN POTS

Individual attention can be given to the wants of each plant. The fruits are supported by a piece of wire screening to keep them off the soil and pot

FORCING ON BENCHES

This style of house is cheap and is made of hotbed sash. The bench method is easier and cheaper than growing in pots, but the berries are not so fine

4. The plants, being under the control of the grower, can be ripened off better in the fall.

5. Pots require only a small space, so that few or many may be in houses of different temperatures, or the pots may contain plants in several stages of producing fruits.

6. The convenience of pots — light, easy to handle, very little storage place needed, etc.

The principal drawback to pot culture is the first expense, the purchasing of pots; but with reasonable care they will last several years. Then the expense of bench and pot culture should be about the same.

After the potted plant has been removed from the field it is taken to the potting shed to be shifted to a larger sized pot, usually a six-inch one, sometimes called a fruiting pot. The soil used at this time can be either the same as that of the bed, or may be three parts sod compost to one part sharp sand, with about one pint of very fine ground bone to every bushel of soil. Of course potsherds or some material for drainage should be placed in the bottom of each pot to allow for ample drainage. This is doubly necessary because large quantities

of water are to be used in the forcing and fruiting period, and it is important that the strawberry plants do not have too much moisture around the roots.

Many growers advise the plunging of these pots, almost to the rim, in some coarse material, like coal ashes or spent tan bark, in order that the earthworms will be prevented from entering the pots. Other growers replace the pots in the soil near the parent plant, especially if water for irrigation or sprinkling is handy. Otherwise the pots are placed with convenience for watering, as this is the main thing necessary during the growing season.

Sometimes, for convenience, or for the purpose of protecting the plants during heavy thunderstorms, the pots may be placed in coldframes without the glass. In the fall, about the first of October, it is time to consider ripening off the plants. At this time the plants will have attained their full growth and the pots will be filled with their roots. Less water should be given and a drying out of the soil in the pots should result.

There are two reasons for this drying off the potted plants:

1. Firmer and larger crowns will be developed.

2. The pot will not be broken when the freezing weather comes.

In the first case, this drying off represents the dry fall season and causes the plant to store up material in the crowns for future use. The plants are then in the right condition for the subsequent forcing.

Freezing of the soil in the pot when there is considerable moisture in it causes pressure on the side of the pot and finally breaks it. This, of course, is a needless expense and should not occur. It seems best for the future forcing that this freezing should take place, although it is not necessary. This freezing gives the plant the idea that the rest period has actually come, and it often results in better crops, both in quality and size of berries.

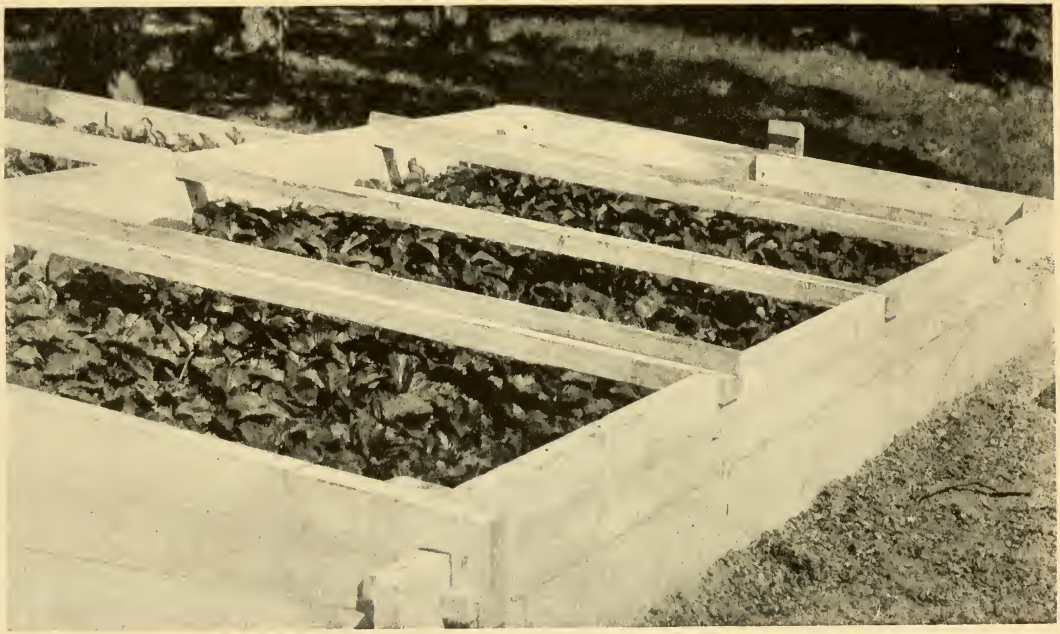
The potted plants are taken from this frozen condition and placed in suitable storage rooms where they may be taken out with the least inconvenience.

Generally speaking, from the time the plants are brought into the greenhouse until fruiting, there is a lapse of eight to ten weeks,

sometimes twelve weeks passing before ripe strawberries are ready, variation in the time being due principally to different conditions of sunlight and temperature. If ripe strawberries are desired in January, then the plant must be started early in November.

When the plants are brought under the forcing process in the houses, the temperature for the first two or three days should be held at 35 degrees, day and night. After this time slightly higher temperature may be given, or the pots may be changed to another house. At the end of the first week 45 degrees should be registered. The second week-end 10 to 15 degrees higher in the daytime is required, with a night temperature of not less than 50 degrees. After this slightly higher day temperature may be given, 75 to 80 degrees, with 55 to 60 degrees at night.

The pots may be set on shelves or any convenient place in the house, nearer the glass in darker houses with less attention as to nearness of glass in the so-called "daylight" houses. If the pots are to be placed on the benches, they may be plunged to near the rim, in either spent tan bark or coal ashes, as these materials will give good drain-



PLANTS IN THE COLDFRAME

These plants are to be forced. They are in six-inch pots plunged in cinders, which provide drainage and keep out worms

FORCED MARSHALL PLANTS IN FRUIT

The crop is so heavy that artificial supports are necessary. Usually it is better to cut off all but about ten berries

age and still retain enough moisture. When the leaves start growing it is sometimes best to spray with bordeaux mixture, as a preventive against the leaf spot. This spraying may have to be repeated later, according to the appearance of the plant. Wetting of the walks should be discontinued at blossoming time. This is highly necessary if fruit is desired as the pollen will not ripen in a moist condition of the air. Good ventilation at flowering should also be in order, especially at midday, still maintaining the required temperature.

Pollination is carried on by hand, generally during the middle of the day. There are several ways of giving pollen to the pistils. Some growers pick off a flower here and there and thrust it into an attached flower; others merely tap the flower with a pencil, causing the pollen to fall on the pistil.

The most common method, however, is that of collecting the pollen in a watch glass, spoon, or ladle and applying it to the pistils with the aid of a camel's-hair brush. Some varieties may be able to produce fruit without this artificial pollination; nevertheless, the majority of growers prefer the hand method.

When the fruit is set, all but six or eight of the very best fruits should be picked off. This will result in greatly increased size of the remaining berries, as the full strength or life of the plant is given to produce these few. At this time it is a good practice to give the plants an application of liquid manure, made by diluting well-rotted cow manure with water. At first the solution must be weak, and not applied very often, one dose in four or five days being enough, increasing the number of applications as the size of the fruit progresses. Also slightly increase the strength of the liquid.

At ripening time it is important to be very careful in applying this, ofttimes it is better to use clear water than to discolour the fruit with the former watering.

As the fruit swells and hangs so that it can touch either the soil, pot, or wood, it is often best to give it some support in order that the fruit may be ripened all over. Small meshed window screening, cut so that it can hold up the fruit, is very good. Pieces of hay wire bent so that the fruit will be held away from the pot are also used.

The fruit should be picked as explained

in another chapter, and should be very carefully packed to show itself off. The Leslie box lined with white paper is the best one for attracting attention. The plants are worthless after once fruiting.

The price received for this fruit is extremely high as compared to the out-of-door fruit, but it is generally purchased by those who can afford the fruit out of season and 50 cents to $1 or more a box is no drawback if these parties have the taste for strawberries out of season.

CHAPTER IX

Propagation, Breeding

The strawberry is one of the easiest plants to propagate; in fact, nature has arranged for the production of offspring from the plants. There are two ways by which the plant is propagated that are worthy of consideration:

1. By seeds.

2. By runners (or rather, new plants produced at certain points on the runners).

The first process is the one that is so common among our wild strawberries, where the fruit matures and the seed drops to the ground, there being partly covered up and either germinating that summer; or, if the conditions are not right, it may lay over until the opening of spring the following year. Man has stepped in and used this seed method of propagation for the production of new varieties.

For the practical farmer, suburbanite, or grower, who has no thought or time for the first process of propagation, the second is the only feasible one to consider.

This method consists of setting the plants in well enriched and prepared soil and giving the runners the best possible opportunity to grow and produce plants at the joints. If the soil is particularly fine (sometimes a top dressing of well-decomposed manure is advantageously applied) around the plant so that the roots from these new formed plants can obtain a foothold quickly, the resultant growth is more satisfactory.

It is generally considered that the first plant which is produced on each runner is the best, and this is true in one sense — that is, that being first it has a longer time to develop and, therefore, is larger in the fall of the year. Nevertheless, the second or third plant produced is just as good as the first, as far as its ability to produce fruit, etc., is concerned.

It has sometimes been noticed that, owing to better soil conditions around the second or third plant produced on a runner, these

plants outstrip the first produced, where the soil is not in such good condition.

It is better not to allow overproduction of new plants by the parent. Four runners with one plant, possibly two, on each will return larger plants in the fall than where the plant is allowed to produce great numbers of runners and plants.

There is a great difference in the relative power or characteristics of certain varieties of strawberries to produce plants. Some, like the Marshall, Gandy, Texas, etc., are shy bearers of young plants; while other varieties, like Stevens' Late Champion, Michel's Early, Dunlop, will over reproduce. Careful attention must be given these latter in regard to thinning the plants if a full crop of large berries is desired.

After the new plants have become firmly established, the runner from the old plant to the new is broken, and the new individual has its own way to work, without further help from the parent. At this time, or later, the new plants may be moved to their new places in the bed that is to be set out each year, being sure that the plant that is lifted from the old bed has many strong yellow

to whitish coloured roots. If it has black roots, it is not a new freshly produced plant, but is an old plant. These old ones are not as desirable to set out, as larger and better fruit is produced on younger plants.

There has been much talk about the pot-grown plants which are advertised for sale in the late summer or early fall. These can be easily grown by filling with good soil and sinking a two or three inch pot into the ground just under the joint in the runner where the new plant is to develop. When the new plants have produced a sufficient number of roots, so that the pots contain a compact mass or ball, the runners are carefully severed and the pots with the plants are lifted and are ready to sell.

They may be sent to the purchaser with the pot, or the pots may be removed and each plant rolled separately in a piece of paper, generally a newspaper, or may be packed in boxes and shipped without wrapping. One hundred plants, pot-grown, cost without pots, about $3, or 50 cents a dozen.

The cost of these plants is, of course, more than for the spring or fall dug plants, owing to the labour involved and the fact that

practically the whole plant is sold. It is possible, by using plants that have become well established in the pots, or those that have had a fair length of time to develop, to get a moderate crop of fruit the first spring. This, of course, would be of more importance to the small grower, farmer, or fancier, than to the large commercial grower, as the extra expense in either growing or buying the plants would be practically out of the question for the large grower, who caters to the general market, and must produce large crops of fruit in order to make a profit.

There is one point that must be very carefully observed in the propagation of plants. When the mother plant is set in the bed for the purpose of producing other plants, it must not be expected to produce fruit as well as plants; therefore, all blossoms must be picked off the mother plant. This is also the best practice for newly set beds in which the first year the original plants are expected to produce a heavy crop of offspring. The grower must be reasonable, and remove the buds as soon as observed, thereby giving the strength to the propagation

of plants rather than to the exhaustive work of producing buds, flowers, pollen, and fruit.

PEDIGREED OR THOROUGHBRED PLANTS

What is meant by the word "pedigree" or "thoroughbred" as applied to the plants of the strawberry? The words signify that the plant is of a particular strain, or that it has a known "line of ancestors," sometimes called plant genealogy. It may be the result of breeding of two good parents and the subsequent selections of the best offspring each year, until a constancy or fixed characteristic or habit is maintained. Another method may be nothing but the selection of the best producing plants of some variety for a long term of years. This may be started in the home garden where the plant is selected that produces: (1) The largest number of berries; (2) the largest number of well-shaped berries; (3) the largest number of large-sized, uniform berries; (4) the most vigorous, healthy plant, coupled with the three other characteristics.

This plant is removed from the bed after fruiting and set in the well-prepared propagating bed for the production of plants.

These plants may be allowed to fruit the next year, and one or two, that have even better qualities than the parent, may be selected and placed in the propagating bed after fruiting. New plants are thus obtained which are, the following year, subjected to the process of choice selection.

This selection may be carried on for years and years, and, if the grower has some good ideals to select to, each plant will tend to be of higher quality than its parent. There may be poor seasons; as drought, frost, and insects, or other injuries may somewhat hinder, but the results for an average number of years will be of great value to the grower who practises this process of selection.

Many times a person has not the time nor the inclination to practise improvement of strawberry plants by selection, and it is fortunate that we have engaged in selling plants to the public men that do take pains to produce plants that are thus pedigreed or thoroughbred.

POLLINATION

The statement is often made that certain plants must be planted with reference to

STRAWBERRIES IN FLORIDA

The Northern markets have fresh berries all the year round now. After the forced crop from nearby growers comes the outdoor crop from the South

IRRIGATION

The hose is often the only method by which the bed may be irrigated. It undoubtedly saves hundreds of quarts of strawberries, thereby increasing the net return

pollination. Now just what is meant by this term?

To give a clear idea, a little of the detail of the growth and development of flowers is necessary. When the flower of a strawberry opens, around the outside edge is seen five white leaves, called petals. One of their functions is to attract insects to the blossoms. Toward the centre of the flower are seen a lot of little tubelike bodies with caps on their heads or tops, called stamens. In these caplike bodies are small grains of a yellow substance, called pollen. This is the male part of the flower and is the part that when placed, at a certain time, on the top of the pistil of a strawberry flower, germinates or grows, sending down a small tube or root into the ovary of the pistil, there uniting with the female parts and starting the growth and development of the seed and flesh of the fruit. By this it is seen that to obtain strawberry fruits, pollen must be produced and deposited on the top of the pistil.

At the centre of the flower, underneath the stamens, is found a collection of vaselike structures. These are the pistils. Each pistil develops a certain part of the flesh of

the fruit if properly supplied with pollen, or pollinated. It is, therefore, seen that all the pistils must be pollinated or deformed fruit will result. At times, some of the pistils are killed by frost. This gives a deformed or lopsided fruit, the same as produced by the lack of proper pollination.

All varieties of strawberries have the pistillate parts well developed. But some are defective as to the stamens. The latter are classed as "pistillate" (P.); the others as "perfect" or bi-sexual (B.).

The question now arises, what has this to do with the planting of strawberries? With a clear understanding that there is such a thing as sex in plants, then it is possible so to plant that deficiencies in one line or the other may be overcome.

Such pistillate varieties as Bubach, Haverland, Sample, Warfield, and others, should not be planted alone, but should be mixed or planted with such bi-sexual varieties as, Senator Dunlap, Wm. Belt, Excelsior, Lady Thompson, etc. — that is, plant one or two rows of the pistillate, then one row of the bi-sexual, and so on throughout the entire bed. Even Glen Mary, which is a weak

bi-sexual variety, or pollen bearer, is made to produce more by interplanting with Wm. Belt than if planted alone.

The tendency then by interplanting with bi-sexual varieties among pistillate varieties is to facilitate the transfer of the pollen from the bi-sexual varieties, by the aid of wind, insects or other means, to the pistils of the pistillate varieties, and in this way fruit will be borne on plants that would otherwise be non-productive.

This little discussion on pollination may help to explain why many beds planted to one variety alone have not borne fruit.

SPREAD OF POLLEN

When the flowers have opened and the pollen is ripe for the use of pollinating, there are several agencies that are active in the spreading of this yellowish dust, which is so important in the production of fruit. Among these agencies there are two that are very important: (1) Insects and (2) wind.

The various insects are seen flitting from flower to flower, perhaps taking something from the flowers, as in the case of the honey

bee who is after nectar, but more often doing an immense amount of good in knocking the pollen from off the anthers on to the pistils, or coating parts of their bodies with pollen which is again deposited in the next flower or some others visited by the insect, thus bringing about proper pollination and fruitfulness of the plant.

The winds help in knocking off the pollen and carrying it to other blossoms. Both of these agencies are nature's way of aiding either cross or self pollinating by the flowers and would be called the process of natural breeding.

Providing one of the fruits which was matured this way was used to produce new plants from the seeds on the outside of the berry, it would be practically impossible to tell more than one parent of the resultant offspring. This being the case, the new plant would have just as much tendency to degenerate as it would to improve. Man has stepped in and, by a simple process, and by his knowledge of the parents of the offspring, and knowing just which parents will breed together the best, has eliminated much of the chance in breeding.

Small paper bags are put over both parents, so that no possible outside pollen can come in. The flower which is to be the female is emasculated — that is, the stamens which bear the pollen are removed just at the time when the bud is about to blossom forth as an open flower. A small sharp implement is used, cutting through the petals and removing all the stamens. The blossom is then rebagged. When the pollen is ripe on the other bagged blossom, the bag is removed and the pollen knocked onto a watch glass or other receptacle and this powder is immediately applied, by the aid of a camel's-hair brush, to the emasculated flower so that the pistils have sufficient pollen for pollination and fecundation, which results in clean, well-shaped fruit. It may be necessary to pollinate the flower twice to be sure of supplying enough pollen.

The flowers are bagged at once and remain so until the fruit has attained some size; then the paper bag is exchanged for a mesh bag either of very coarse cheesecloth or mosquito netting. This latter bag remains on until the fruit is fully matured.

The fruit is picked when "dead ripe" and the seeds may be sliced off with a knife, having a small part of the flesh attached, and planted in a flat of wet sand. After two or three weeks, if the flats are kept in a moist, cool condition, some of the seed will have germinated and come up above the ground.

These small plants may be allowed to develop until three inches high, when it is best to transplant them into a pot of good garden soil or plant them outdoors in the nursery rows.

The very best care must be given during the summer and fall, also good winter protection provided. The following spring and summer the plants are allowed to set new plants and to make a good growth. Fruiting should not be allowed this year for the best results, however; the second spring fruiting is in order and selection of new improved varieties should begin, following out the selection process along the lines laid down for pedigree plants.

The beginner in breeding should not be disappointed if the results of breeding are not fully up to his expectations, as the possibility of obtaining a worthy variety is

becoming harder each year. It may be best for the amateur to improve some highly recommended variety by the process of selection, leaving the breeding to the specialist or fancier.

Some of the common crosses made have been McKinley x Ridgeway, Glen Mary x Wm. Belt, Hunn x Ideal, Wm. Belt x Wild strawberry, Ridgeway x Wild strawberry, and so on through numberless combinations.

Observation made upon the sex of seedlings produced by cross-breeding have been somewhat interesting.

14 seedling plants of Bubach P. x Wilson B. formed 5 with B. blossoms and 8 with P. blosoms.

14 seedlings of Bubach P. x Wm. Belt B. formed 8 with B. blossoms and 6 with P. blossoms.

48 seedlings of Glen Mary B. x Wm. Belt B. formed 47 with B. blossoms and 1 with P. blossoms.

30 seedlings of Hunn P. x Ideal B. formed 21 with B. blossoms and 9 with P. blossoms.

Some of the bi-sexual blossoms, though, were very weak in pollen. One of the plants of this last cross proved quite promising and a description of the offspring is here given: (Note. The description of the parents of these seedlings is given under *Varieties* in the last chapter.)

Leaves — Large, dark.

Sex — Perfect.

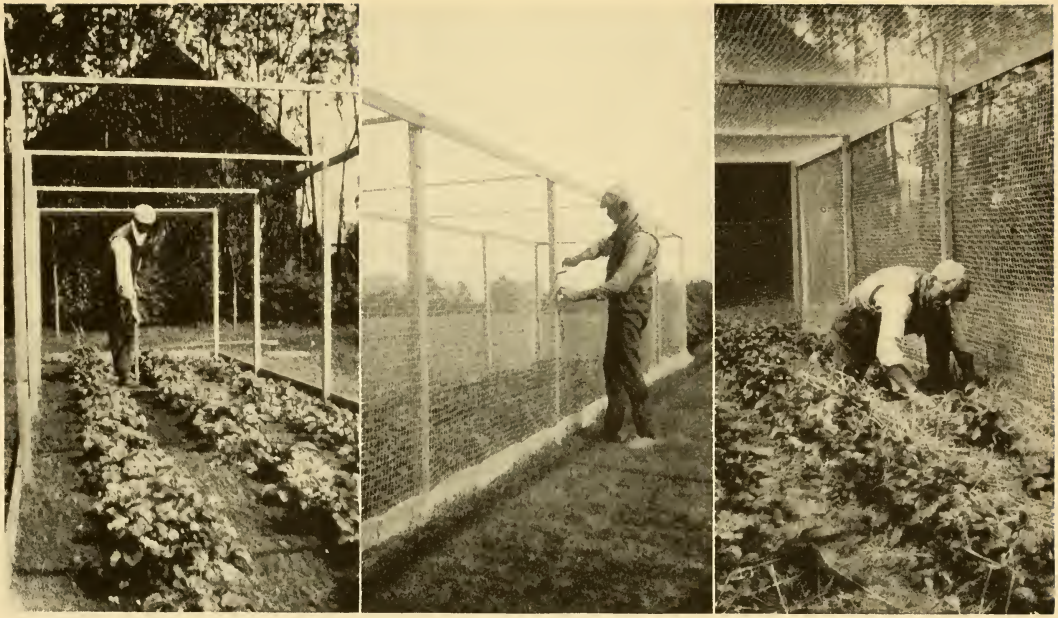
Season — Medium. Fruit stems numerous.

The fruit is conical in form. Size, large. Colour, light red outside and inside. Quality good, sub-acid. Yield, good. Fine appearance.

In the cross Hunn x Ideal it was hoped to unite or combine ideal form with late ripening. The results, however, showed that the plants retained the characteristic foliage of the Hunn, being dark green, growth dwarf but quite vigorous. Runners strong and rugged but very few produced. The fruit was regular in form, colour, dark red and glossy. Flesh, dark red. Flavour, very acid.

A cross of Wm. Belt x Wild made with the idea of frost resistance produced quite good results. The plants retained the characteristics of the wild, setting many plants and making a thick, matted row. Frost resistance quite pronounced.

Colour of the fruit is bright red, seeds deep sunken with the wild characteristic, sharp corrugations above seeds. Flavour quite pronounced of the sweet wild quality. Size larger than wild. Some measure from $\frac{7}{8}$ to



PROTECTING STRAWBERRIES FROM THE BIRDS

While the plants are in bloom they are quite in the open, but chicken wire is attached to the frame to protect the fruit. Subsequent work is done with ease

AS A DECORATIVE PLANT

Few appreciate the decorative value of the strawberry plant — the masses of white flowers followed by the rich crimson fruit

$1\frac{1}{8}$ inches in length and $\frac{3}{4}$ to 1 inch in diameter. Shape of berry is short conical with slight neck.

One step further with this above seedling, McKinley x [Wm. Belt x Wild] produced a plant which showed good vigour and disease resistance. Leaves, numerous, tall. Sex, perfect. Season, medium. Runners, long and quite numerous. Fruit stems weak, short. The fruit is large in size for a wild cross. Light red in colour. Rather flattened conical in shape. Quality good, still retaining some of the wild sweetness. Frost resistance still good.

These are two very good examples of double cross-breeding and the results show a little of what may be expected by careful breeding. By comparing the description of the parents given in the last chapter of this book with the following offsprings' descriptions, more interest in the subject will be produced.

FIRST EXAMPLE

Variety Glen Mary x [Bubach x Wilson] resulted in a seedling of the following description.

Sex, pistillate. Season, late. Fruit, size medium to large. Runners, long, strong. Fruit stems, short. Leaves, large, tall, dark green, somewhat wrinkled. Colour, bright scarlet, attractive. Flavour, resembling pineapple, good. Calyx, large, spreading. Yield, medium to large. Disease resistance, good.

SECOND EXAMPLE

Variety [Bubach x Wm. Belt] x Glen Mary.

The plant shows good vigour:

Leaves, dark green, curled. Runners, few. Fruit stem, short, strong. Sex, bi-sexual. Season, late.

The fruit is:

Size, very large. Colour, bright scarlet. Quality, good, sub-acid. Form, ovate, flattened, somewhat irregular. Calyx, depressed.

Taking by selection the best of these breeding experiments, it is possible in a few years to obtain something quite satisfactory and new in the strawberry world.

CHAPTER X

Scoring and Judging

This is part of the strawberry industry that has been somewhat neglected. Many judges base their choices for prizes more on the package, packing, and general appearance of the fruit than upon any specific characteristic.

There should be some very careful measurements made of strawberries of different varieties until a standard for each variety is worked out. These measurements should embrace the following:

1. Measurement from tip of berry to highest point of both shoulders.

2. Measurement from shoulder to shoulder.

3. Measurement of the circumference of the shoulder.

With these measurements it would then be possible to judge correctly the size of each variety and the uniformity of this size.

A detailed study of the colours of strawberries should be made and a standard for each variety given, as dark red, red, scarlet, crimson, or some combination of these, and have these colours conform to some commercial standard.

Such characteristics of quality as acid, sub-acid, sweet, mild, aromatic, melting, gritty, poor, etc., should be stated, as well as the fact that the berries mash easily or not, or are good, medium, or poor shippers, each one being a standard for each variety.

There has been some work done on the shape or form of berries and there is some conformation to the characteristic shape of each variety of berries. It is possible, however, to find on some plants berries shaped like a top, and on other plants of the same variety berries of a coxcomb shape. By this it is seen that it is highly important that some standard for each variety should be established, in order that in all parts of the country strawberries of each variety may conform to some set requirements and when exhibited there will be more similarity between samples of the same variety.

For quick judging of the ripe fruit, the following card, with its scale of point, is quite handy:

SCORE CARD

Size of berries			20	points
Uniformity of size of berries			20	"
Colour of berries			20	"
Quality	Commercial	Shipping 20	25	"
		Flavour 5		
	Home	Shipping 5		
		Flavour 20		
Shape of berries			15	"
Total			100	points

For more detailed scoring of the whole plant as well as the fruit the following card is recommended:

STRAWBERRY SCORE CARD

Scale of Points	*Part of Plant*		*Marshall*	*Warfield*	*Dunlap*
5	Blossoms				
	a. Staminate (many)		4		5
	b. Pistillate (many well formed)			5	
25	Productivity of plant for fruit		16	22	22
23	Fruit	8 size of berry	8	6	7
		7 colour of berry	7	7	7
		5 shape of berry	5	5	5
		3 flavour of berry	3	3	3
15	Shipping quality of fruit		13	14	14
5	Rust proof or other diseases		3	4.5	4
8	Ability to produce plants		3	7	8
5	Foliage (leaves and stock)		5	4	4.5
7	Drought resistancy, vitality		6	6	6.5
7	Root, large, well formed		5	6	6
100	Total		78	89.5	92

These cards can easily be used as guides for judges who have not a complete system of classifying and scoring the fruit at the fairs or shows. The card would be of special value if there were a question raised by some grower of the fruit judged, the answer, or defect in the fruit could be readily ascertained from the score card.

A good judge could go through the exhibits of each separate variety and pick out the few that were closely matched for first place; then, by careful scoring, the first, second, and so on would be readily shown.

One of the best score cards is that by Professor Card, published in a report of the Rhode Island Experiment Station, 1905, and is presented herewith:

STRAWBERRY		
Variety		Scale-points 10-perfect
	Plant	
Vigour	Disease resistance	Frost resistance
	Fruit	
Productiveness	Size	Regularity
Appearance	Texture	Quality
Fragrance	Rot resistance	

Also a good form for the description of strawberries.

DESCRIPTION

Plant

Leaves.....
Runners.....Fruit stems.....
Bloom.....
Season.....Sex.....

Fruit

Form.....Flavour.....
Colour.....Colour of flesh.....
Calyx.....Core.....
Seeds
Position.....Size.....Colour.....
Season
First.....Heaviest.....Last.....
General Notes.....
.....
Date.....
Observer.....

To simplify entering the records, the following key was devised:

LEAVES

Number
n—numerous; f—few

Size
l—large; sm—small; m—medium

Height
t—tall; s—short

Colour
d—dark; lt—light

SURFACE

r—rugose; gl—glossy; c—curled; w-wrinkled

Runners
st—strong; w—weak; n—numerous; l—long; s—short; f—few

Fruiting stems
st—strong; w—weak; l—long; s—short

Number of fruits
n—numerous; f—few

Bloom

Season

e—early; m—medium; l—late

Sex

p—perfect; i—imperfect

Size

l—large; sm—small; m—medium

Form

i—irregular; reg—regular; cox—coxcombed; ang—angular; ft—flattened; s—short; l—long; r—round; c—conic; o—oblate; ob—oblong; ov—ovate; obt—obtuse

Flavour

a—acid; sub—subacid; ft—flat; s—sweet; sp—sprightly, msk—musky.

Colour (Based on Brainard & Armstrong's coloured silks)

l—light; d—dark; o.s.—opera scarlet; n.s.—new scarlet; s—scarlet; car—cardinal; cr—crimson.

Calyx

d—depressed; c—close; r—raised; l—large; m—medium; s—small.

Core

s—solid; sp—spongy; h—hollow.

Seeds, position

r—raised; d—depressed; d.d—deeply depressed; p—prominent.

COLOUR

l—light; c—coloured; m—mixed.

CHAPTER XI

Costs, Yields, and Profits

After a careful perusal of the former chapters of this book, it will be necessary to give the reader some fairly definite statements as to the costs, possible yields, and profits, which may be obtained from the business of modern strawberry growing.

This is, however, more easily said than done, as it is next to impossible to obtain reliable figures on these points, owing to the fact that so few men engaged in this business keep any exact records of the expenses or returns from their crops.

There are also several other factors which enter into the production of a good crop, costs, and profits, such as:

1. Good markets near by.

2. Good roads or transportation to market — street, electric or steam.

3. Plenty of labour, at a low price, and in the season.

4. Cheap land.

5. Manure or fertilizer, home-made or at a low cost.

6. Favourable seasons for large yields

7. The man. He must have business ability and gumption, coupled with common sense.

To take this matter up a little more systematically let us first consider the costs.

Letters received from the North, South, West, and East show that the average amount of money put into an acre of strawberries is about $100, some returns showing as low as $45 and as high as $150 per acre. The majority of these estimates, however, do not include rental or interest on cost of the land.

One of the best worked-out estimates for one acre, valued at $200, is the following:

Interest and taxes	$ 15
Ploughing, harrowing, etc.	6
Value of 12,000 pedigreed plants at $6 per M	72
Manure, fifty loads at $1 per load	50
Marking ground and setting plants	8
Summer cultivation	10
Training runners around the plants	5
Winter covering and cost of putting it on	15
Taking off winter covering	5
Total	$186

The actual cost in money to the farmer for just one acre would be something less than this because, generally speaking, the ploughing, harrowing, cultivating, marketing, setting, training, etc., can all be done without much, if any, outlay of cash by the farmer. Then, if stock is kept, the manure cost would be reduced or done away with. Also the cost of winter covering can be greatly reduced, as it would be but a slight expense to raise enough rye, oat, or barley straw for this purpose. In fact, the actual cash outlay to the farmer would figure out something like the following:

Taxes	$ 5
Plants	72
Winter cover (home raised) seed and fertilizer	8
Labour, horse and man, not any actual money outlay	
Total	$85

Added to the above cost in both cases would be the expense of harvesting and marketing:

8,000 qts. at 2c. for picking	$160.00
8,000 boxes, qt. size, at $3.50 per M, less 5%	26.60
250 crates, 32 qt. size, at 30c. per 100, less 5%	71.25
Total	$257.85
Total all costs figured in	443.85
Total farmer's costs	362.85

YIELDS

The yields vary so much that no two returns, nor two years, are alike. This is owing to many such factors as:

1. If the season is dry, then low yields.

2. If the season is excessively wet, especially at fruiting, yields may be large but rot reduces the actual returns.

3. The soil has a great influence on yields.

4. Drainage and irrigation are important for the largest yields.

5. Manure and fertilizer available at the correct time are important factors.

6. Preparation of the soil for the crop should not be ignored.

7. After culture, as cultivating, hoeing, training, is required.

8. Varieties and their adaptability to the climate, soil, etc., demand close attention.

It is easily seen that this producing of large crops is not as easy as might be at first considered, but by careful businesslike methods, year in and year out, it is possible to harvest an average high-yielding crop.

In the West, the Bederwood produces from 300 to 500 crates per acre in good seasons. Even as high as 800 crates of certain berries,

under very good systems of management and on small tracts, are reported.

In the East Mr. Kevitt reports close to 50,000 quarts being produced per acre by his system on his place. Others report 20,000 quarts, and these reports dwindle down to the very low figures of 3,200 quarts per acre, and in some cases less.

For a normal year a crop of 300 crates or 9,000 quarts per acre should be considered a good yield, and a grower who could not produce at least 100 crates, or 3,000 quarts per acre, by following the instructions given should go out of the business and follow some other line to which he is more adapted.

PROFITS

The figures given show that the total cost for an acre of strawberries under very good management is $443.85, with an actual outlay of cash by the farmer or small grower of perhaps $362.85. A fair yield is about 8,000 quarts with a possibility of a good one of 300 crates (9,600 quarts). The average prices in a large number of cities and towns is 12 cents a box where sold at retail, with a wholesale average of $2 a crate for good berries.

It must be remembered that these figures are for good berries and do not include soft, poor, or mushy berries, which often bring but 50 cents a crate; nor does this price include the fancy fruit which sells for a premium of 5 cents to 10 cents per box. At these figures the returns will be:

8,000 qts. (250 crates) at $2	$500.00	$500.00
Minus costs total	443.85	362.85
Net profit	$ 56.15	$137.15

If the berries were sold at retail the returns would be:

8,000 qts. at 12c.	$960.00	$960.00
Minus total cost	443.85	362.85
Net profit	$516.15	$597.15

Some readers will think these figures are excessively high and others will consider them quite low, but the author's experience has shown that there are more in the medium class than in either of the above classes, so it is important that the figures should not be of excessively low returns nor of too high rank.

An average of the estimates show the cost of producing a crate of berries ready for

market is about $1.07; subtracting this from the average wholesale price per crate, $2, would leave a profit of 93 cents which, multiplied by the number of crates produced, would give the net profit:

250 crates at 93c. per crate	$232.50
300 crates at 93c. per crate	279.00
800 crates at 93c. per crate	744.00

These returns are far in excess of the average of farm crops in general and they compare very favourably with some of our large net returning market garden crops.

CHAPTER XII

Strawberries for the Home

The home grower of strawberries has the greatest opportunity in the world for producing the largest size berries, the highest quality of fruit, and the greatest quantity per square foot, as each inch of the necessarily small patch can be, and should be, under his control.

The home grower will find even in the small patch of soil that could be devoted to strawberry raising some spots that respond more willingly to very successful production of this luscious fruit. Therefore, he can in a limited way have some choice of site for the bed. Many times it is possible to make a very fine bed out of an unfavourable location, particularly so if artificial methods of irrigation, drainage, supplying humus, and other accessories are installed.

Generally speaking, the proposed bed can

not be ploughed, harrowed, etc., in the regular way, but has to be spaded, followed by working up with a rake. Nevertheless, where the bed is large enough, the horse work should be done unless particular attention is desired in soil preparation. The suggestions made in the chapters of this book on soil preparation should be carefully followed, as should other matters pertaining to this crop.

The majority of the beds in the home garden are raised beds, that is to say, there is a slight ditch surrounding the patch and the soil inside this trench is higher than that outside.

After the bed is thoroughly prepared, the marking out should follow, and planting very soon after that. The best results in the home garden, where very intensive methods will be carried on, are obtained by the hill system of planting. According as the bed is neglected, the system used will approach that of the matted row. This last system is the least desirable for the home grounds, as it does not correspond with the necessarily intensive methods that should be carried on there, nor does it produce the quality or size of fruit that the other method will.

Planting and fertilization should be the same as spoken of in the chapters devoted to the subject, fertilizers being reduced in quantity to accommodate the decreased acreage. Cultivation should be given more often than for a larger patch. The use of the wheel hoe is particularly recommended for this work. This tool is so useful that by skilful operation very little or no back bending or hand work of weeding will be necessary. Deep cultivation is recommended at first, with shallower work later.

Insects and disease pests can be controlled quite easily. By using a knapsack or small Auto spray it will be possible to spray the plants from early season until late, with but little expense and not extra-hard labour. A reduction of the formulas given in this book for larger beds will be necessary, but this is only a question of mathematics and can be easily solved by the home grower.

Mulching, and the winter and spring care of the bed, as elsewhere mentioned in this book, are very necessary and should be carried out by the small grower in some detail.

As the following spring opens and the plants begin to renew their growth, an appli-

cation of complete fertilizer followed by one or two smaller ones of nitrate of soda would be very beneficial to the plant, particularly so if it was seen to that a sufficient supply of water was afterward added to dissolve the fertilizer materials. More water, if nature does not supply, should be given after the fruit sets, as it is not possible to produce good-sized, shapely, and quality fruit without a continuous rapid growth. If no other form of irrigation is available than the garden hose, attach it to a lawn sprinkler and let it run, changing the location of the sprinkler every hour or so, according to how fast the soil is wet and the kind of soil.

After all this care, who could expect anything else but the highest quality strawberries, the kind that are prize winners at fairs and exhibitions? The results will be fully in accord with the labour bestowed.

AUGUST PLANTING

By planting potted strawberries in August instead of runner plants in April one can have bearing plants the next season, besides being able to get a crop of peas, beans, early corn, etc., from the ground before the berries are

planted. Whether your soil be heavy or light, trench it two spades deep, turning in a liberal quantity of manure. When trenching, always remove a pit large enough to give you plenty of room to work, and then throw the topsoil to the bottom of the finished bed, distributing your manure as evenly as possible during the digging. Use a wagonload of manure to every 100 square feet of bed on extremely light soil, reducing for heavier soils. Virgin soil of good texture would require only about half this amount.

When ordering your plants be particularly careful to get them from a reliable source; if the soil has been shaken from the roots by the time the plant reaches you, it is not worth planting, for it has suffered a check and will not bear satisfactorily the following season.

If you already have a strawberry bed you can raise your own plants each season by simply potting up the first runners that appear and setting them in a coldframe where they can be shaded for a few days and carefully watered. For shading use frames made of cheesecloth, which can also be used for protecting seeds and seedlings, to prevent lettuce from going to seed, etc. When the

berry plants are well rooted, set them out in the bed.

Mark off the bed in drills before planting, using a line and draw hoe, so as to guarantee straight rows. Mark off the rows two feet apart and set the plants one foot apart in the row. Of course, this applies only to gardens that are to be cultivated by hand. Be sure that the staminate and pistillate flowering types are planted in sufficiently close proximity to insure proper fertilization. This is done by planting in alternate rows. Use a trowel for planting and for measuring the distances, most trowels being one foot long (six-inch blade and six-inch handle). Put the plants in a flat or small box, after knocking them out of the pots, and drag this along the drill, setting the plants as you go, using the trowel to space them. If the ground is mellow, all that need be done is to jab the trowel into the soil and press it from side to side until the hole is large enough to accommodate the plant. If, however, the bed was prepared some time ahead and the soil has baked a little, loosen it when planting by jabbing the trowel down into it several times where the plant is to be placed, and

twisting it. Always set the plants so that they will be about the same height above the ground as they were in the pot. Firm the soil around each plant with the hand and then go over the bed, treading down the soil with the feet. Keep all runners removed.

Artificial watering must at times be resorted to, particularly after setting the plants. Give the soil a thorough drenching and the following day, when the surface has dried sufficiently, give deep cultivation. The practice of one successful berry garden on Long Island is given thus by Mr. W. C. McCollom:

"Every year I plant ten rows of berries 100 feet long — about 1,000 plants — and by placing the new plantings alongside of the old beds, they can be worked more economically. I always have three beds in bearing. I throw out a bed after it has produced a crop for three years; after a bed has been in use for two years I let the first runners root, so that the oldest bed gives me the largest quantity of berries, although they are not quite of the same high quality as those produced by the two newer beds. A bed of this size is sufficient for a family of twelve; four people

could be plentifully supplied from 400 plants set out each year, which would give 1,200 bearing plants at the end of three years.

"I believe it is a good plan for every gardener to have a few bell glasses to place over some of the largest plants, so that they can be forced to provide a few berries two or three weeks earlier than the regular crop.

"A great deal depends upon the proper care of the strawberry bed. Cultivate it frequently, keep the runners removed, and in extremely dry weather water it thoroughly.

"As to varieties, I would advise growing such varieties as have proved successful in your locality. Try some of the more promising of the new ones, if you like, but for the greater part of your bed use the same varieties that your neighbour is successfully growing.

"Mulch the bed in fall, but wait until the soil has frozen a little. This prevents the constant freezing and thawing, and if you use a good quality of manure it prevents the bed from running down and producing poor berries. In spring I turn the mulch right under between the plants.

"After applying the mulch, which should

be kept from direct contact with the plants, I cover the beds with a light covering of meadow hay or rye straw. The common mistake is to use too much of this; just a light covering is all that is required. Over this lay some pea brush to keep it from blowing away."

THE SPRING-PLANTED BED

The general routine of management of the strawberry bed has been well described by another successful cultivator (Mr. W. H. Jenkins) thus:

"It is of the greatest importance that the new strawberry bed for fruiting next year (and which was set in spring) be kept free from weeds. Begin cultivation before the weeds appear. Do not wait for the ground to bake hard, but start the cultivator while the soil is mellow. A garden wheel hoe, with large wheels, having such attachments as ploughs, rakes, cultivators, teeth, etc., is the best tool to use. For the first cultivation put on the ploughs and run the wheel hoe both ways between the rows of plants, which should be at least two feet apart each way and in check rows. Cut the soil quite deeply between the rows each way to aerate and

mix the fertilizer with it. Next put the rakes on the wheel hoe and pulverize and level the little furrows left by the plough.

"If you lack space for garden vegetables and wish to do some intensive gardening, sow a row of vegetables, such as early lettuce, radishes, spinach, or some quick-maturing crop, halfway between the rows of strawberries. Put the rows of strawberry plants and the vegetables at least one foot apart. A very good way is to mix lettuce and radish seed and sow them. The radish will germinate in about a week; then one can continue cultivation with wheel hoe. Put on two cultivator teeth on each side of the hoe and run them on either side of the row of vegetables — i. e., straddle it. Clean out all these early vegetables in June, so as not to obstruct the cultivation of the strawberries. If one has elsewhere in the garden plenty of rich soil prepared for vegetables, do not plant any crop in the strawberry rows.

"During midsummer cultivate so that there will be a dust mulch — a fine layer of soil on the surface — that will cause the moisture to rise by capillary attraction. The best way to do this with the wheel hoe is to

use the cultivator teeth as soon as the soil dries out after a rain, then finish with rakes, using the hoe to cut off all weeds as soon as they appear. Only a little hand hoeing will be needed close around the plant. If you keep a horse or can get one easily, horse cultivation with a cultivator having several small teeth is best and easiest, but this should have been planned for when setting the plants by making long rows two and a half feet or more apart. I have sometimes cultivated the long way of the bed with the horse and the short way with a wheel hoe. This makes the soil so mellow that the wheel hoe runs very easily.

"The method of clipping and transplanting runners, if any are left to grow, will depend on the plan of culture you have decided upon. For best results in hill culture, put the plants in check rows not over two feet apart each way; eighteen inches is better for light soils, and for the non-stooling varieties. Hill culture is the highest culture and the plants require more attention. The runners must be clipped every two or three days all summer, the plants watched closely for white grubs which eat off the roots of the plants;

then the bed requires good mulching in the fall to keep the plants alive all winter.

"If the white grub appears try the carbon bisulphide remedy. Just pour a tablespoonful of the liquid on the crown of the plant, letting it soak into the soil.

"Probably your best plan will be the hedge-row system, which is to cut all the runners until about July 1st, when bed one or two of the strongest runners on each plant in the rows so as not to interfere with running the cultivator one way. After this try to keep all runners cut, and a dust mulch around the plants and the weeds destroyed when they first germinate.

"It is very bad practice to dig plants from the fruiting bed to make a new bed in the spring. It is, however, a good thing to make a little propagating bed quite late in the spring, when the leaves are so large that you can distinguish the different varieties, using those which have proved most desirable. One can bed all the strong, early runners at one end of a row, placing them around the mother plant like the spokes in a wheel and holding them down by little stones or soil. Keep the bed clean and late in the summer

thin out the plants so that they stand two or three inches apart. I prefer to make the propagating bed apart from the fruiting bed.

"In order to keep the berries from getting very sandy, place a layer of green grass between the rows after the weeding is done. Shallow cultivation is good for the plants all summer, and even up to picking time. With a heavy mulch there will be fewer weeds and less evaporation of moisture. When the berries are picked, mow the plants close to the ground and cultivate between the rows to start a new root growth and a new growth of foliage so as to have new plants instead of old ones for fruiting next year."

SELECTING BERRIES FOR THE HOME

Strawberries for the home garden are measured by a standard of their own. One of the first considerations for market is ability to stand transportation. This means a degree of firmness, or perhaps of toughness, that will stand knocking about and will keep the berries from becoming bruised by the jars of rough handling. Growers for market are compelled to select such varieties, and sometimes this consideration is carried so

far as to annoy the purchaser, who finds he has bought something with the texture and consistency of a Russet apple or a slightly modified piece of cork. It has been very truly pointed out that all these considerations may be ignored in selecting varieties for home use where quality is the first object. The more delicate the texture the better, if only the berries, when thoroughly ripened through and through, will not crush by careful packing and gentle carriage to the house. Mr. James Wood of New York, a man of much experience, has ably expressed this feeling, and makes the following recommendations, which will help the home gardener:

"The points to be considered in valuing a home berry are wealthfulness and vigour in the plant, beauty of form and colour, creaminess of texture, and agreeable flavour. I do not name productiveness because great productiveness is not usually accompanied by high quality. Where the ground in the home garden available for strawberries is very small, it may be advisable to seek a variety that will give a large crop from a small area.

"Good form is important, as it is very

desirable to have each berry a thing of beauty when placed upon the table. To most eyes a rather long berry with a neck between the hull and shoulder is particularly pleasing. Good colour is also important. Some berries, otherwise good, have a dull, dead colour that of itself condemns them. The brighter and clearer the colour, whether scarlet or crimson, the better. Some of the scarlet berries are white inside. By most people a berry is preferred that has a bright red flesh all through.

"Most important of all the qualities, however, is the flavour, but for this we can fix upon no uniform standard. Some persons like an acid berry and some want a dead sweet one, while others prefer some peculiar flavour like that of the old French Hautbois or Alpine. 'Every one to his own taste,' but, whatever that is, the flavour must be good of its kind. As a rule, a sweet berry with a high flavour is preferred. This means a proper mixture of sweetness and acidity, which is the last analysis of the greatest excellence, whether in fruits or in human character. Fortunately the strawberry season is lengthened by the selection of early,

midseason, and late varieties. It is quite easy to make these divisions, but it is very difficult to make a gradation of the varieties constituting each division. A noted grower was asked at a convention whether a particular variety was not earlier than any others. He replied, 'Yes, it may be ten minutes earlier.'

"*Early*.—Excelsior, Michel's Early, Johnson's Early, and Climax are among the earliest varieties, and under the ten-minute schedule they ripen in the order named. The Excelsior is a seedling of the old Wilson's Albany, and has many of the good qualtities of its parent, but it has unduly developed its degree of acidity, and we have discarded it on that account. No one wants to squeal when eating a strawberry. But its colour is very fine, and no variety is better for canning, the colour of the preserved fruit being superb. Michel's Early is an old reliable berry, pleasing in colour and quality. The berries are rather undersized and the plant is not a heavy yielder. Johnson's Early is an improvement on Michel's. Climax is a newer variety, with vigorous plants and fruit of high quality and beautiful appearance.

"*Midseason.*—The midseason varieties are almost numberless. The Cumberland is valuable. It is very sweet, having so little acidity that invalids, and those who cannot take acid fruit, may eat it with impunity. William Belt is good, with a glossy red colour and fine flavour. Nick Ohmer is large in size, of high quality and beautiful colour; its foliage is very handsome. Among the later of the midseason sorts is the Brandywine, with an established reputation. The plants are about perfect in character, and are uniformly good bearers in almost every soil. It holds its fruit well from the ground; the berries are large, of fine flavour and good colour. If we could have but one variety it would unquestionably be the Brandywine.

"Among the well-known midseason berries are some which the home gardener had better avoid. The old Sharpless is one of these, being ill shaped, often coxcombed, and ripens with a white tip which condemns any sort. Another is the much recommended Glen Mary, which is too large in size for beauty or excellence, is ill shaped, and also ripens with a white tip.

"*Late.*—In the late varieties we find the

greatest excellence of flavour. In the North, where there happens to be limited space, so that there is not room for many sorts, it is well to purchase the early supply for the family and devote all the energies to the superb later kinds. First among these we place the Marshall. It is *the* gentleman's berry. It is not so prolific as the Brandywine and some others, but it fully makes up for this in other qualities. The plants are good; the berries are large and well shaped; the colour is very dark and rich, and the same all through the flesh; the consistency is about perfect, and the flavour seems to suit every taste. Every family should grow the Marshall. Upon clay soils the Gandy is very valuable; the plants are fine; it is a good bearer and the colour is very bright and pleasing. The flesh is a trifle too firm for a perfect family berry. This variety should not be used the day it is picked. If placed in a room of moderate temperature for twenty-four hours its flavour becomes properly developed and its quality greatly improved. The Rough Rider is a vigorous late sort of real excellence. The berries are a bright glossy red, of good form and good quality.

Few of the late varieties have given us more satisfaction than Midnight. It is extra large, extra handsome and extra good. At our family table it is asked for in preference to most others. All the varieties here mentioned have perfect flowers, and, therefore, are self-fertilizing.

HOW TO GROW THEM

"While some varieties do best on a sandy soil, and others on a clay, nearly all of them will succeed upon an ordinary loam, whether light or heavy. Where various soils are at commend it is well to plant the different varieties where they will do the best; and as a rule the early varieties will be most satisfactory on sandy soil. The soil should be rich and the cultivation deep and thorough. The question of manure depends entirely upon the richness of the soil. Where the soil is poor well-rotted manure should be used in sufficient quantities to supply an abundance of plant food. Where artificial manures are used it is well to remember that for the weaker-growing varieties nitrogen should be given, say, in the form of nitrate of soda. But this should not be used for the strong-

growing sorts. Potash heightens the colour of the fruit, and generally adds to its flavour. Wood ashes is the best means of supplying potash. A light dressing of Peruvian guano is a good general-purpose fertilizer.

"For a complete fertilizer for strawberries, nitrogen, phosphoric acid, and potash in the ratio of 3, 7, and 9 per cent. is recommended, or nitrate of soda, 150 pounds, bone meal, 550 pounds, wood ashes, 1,400 pounds to the acre.

"The matted-row system involves less labour than hills, gives a great yield of berries, without the fine development of the hill system. The plants are set two feet apart, with five feet between the rows. The runners are allowed to cover the ground, being assisted in proper distribution by being placed in the vacancies by hand. These plants cover one or two feet in width, the remaining space between the rows being well cultivated. Where plants are set too thickly they are removed with a pointed hoe. The next season before fruiting the ground between the rows should be well mulched with litter.

"With either system it is well to cover the plants lightly with stable litter early in

winter *after the ground becomes frozen.* Injury from mould may result if the covering is applied too early. Fall planting is not a success as a general rule, especially on heavy soils. Spring is the best time to plant, and don't let the plants bear a crop the first year if you want the best possible results from them. Concentrate all the force in the second year and then clear off the bed."

IN THE HOME GARDEN

Berries gathered fresh from the plot in the backyard have a quality unattainable in the market

THE ALPINE STRAWBERRY

This has a high flavour. Berries ¾ to 1 inch long produced all through the season. Best fruit from seeds

CHAPTER XIII

Alpine Strawberries

Some interest among home growers of strawberries has been manifested in the growing of the Alpines. This is especially true in the case of those who have journeyed to continental Europe and to England. In the markets of Paris, London, Liverpool, and other smaller cities and towns, strawberries resembling our native wild berries but larger in size are served in the hotels and restaurants, and from their very pleasing taste they have caused many people in returning to this country to try the growing of this so-called Alpine or perpetual strawberry.

In Fuller's classic "The Strawberry Culturist," is an interesting account of this berry which is here quoted:

"The Alpine strawberry (*Fragaria vesca*) is noted for its delicious perfume and its very mild flavour. None of the varieties yield very large berries. However, they are quite

prolific, thriving in positions which are exposed to the cold, where, if other varieties or species were subject to the same conditions, they would die. In Europe there are a large number of varieties in cultivation. European nurserymen in their catalogues quote or give prices on many of these strawberries which may be grown as a specialty. However, the names used in these catalogues are, in most cases, nothing more than synonyms; and by reducing these to possible distinct varieties of this species in Europe, it would probably not exceed a dozen really distinct varieties. In these European countries, however, there are four really distinct varieties, all of which have been under cultivation there and have been known for a long time in this country. The first of these is the Red Bush Alpine. This, as the name implies, produces no runners, and therefore must be propagated by divisions. This plant is an ever-bearer, generally producing from June until checked by frost in autumn. In exceedingly rich soil it is possible for this plant to yield well throughout the entire season. The fruit is medium size, conical in shape, a bright red colour, seeds

quite prominent, not sunken as is usual in the common strawberry, of very mild flavour with a delicate perfume. The second variety is the White Bush Alpine. Excepting the colour of the fruit, which is pure white, it has every characteristic of the previously described variety. The third variety is the Red Monthly Alpine. This plant produces runners quite freely. The new plants produced on these runners will bloom and bear throughout the first season. In this way it is possible to keep up a succession of strawberries from June until the fall. The fruit is very similar to the Bush Alpines. However, it is a little larger. The fourth variety is the White Monthly Alpine. There is very little difference between this variety and the Red Monthly, except that the fruit of this is pure white in colour. The great value of this strawberry is for a conservatory plant where the runners make a very desirable potted plant, trailing over wire screens or hanging from baskets or boxes in the window garden."

In *The Garden Magazine*, May, 1911, Mr. H. S. Adams writes appreciatively of this same type of strawberry as follows:

"It was within a week of the close of July last year when I came upon a large bed of these berries. I was on a flower quest that hot and sultry day, and I confess that the last thing I expected to be offered was strawberries. But I was offered some, right from the plants, and ate thereof with a satisfaction that was a satisfaction.

"Then I began asking many questions; I ascertained, first of all, that these long rows of very flourishing strawberry plants, with a considerable amount of ripe and ripening fruit on them, were all seedlings. The seed had been picked in Switzerland by the grower, from plants of the 'Quatre Saisons' type. This is the small strawberry that is so abundant in Paris, where it is no uncommon sight to see the little hand-carts of street vendors piled high with the much admired fruit. It is simply one of the Alpine varieties bred up in size and general perfection.

"I found also that from this patch of 'Four Seasons' the family had been kept fully supplied with fruit all through July — the Alpines coming in when the ordinary garden berries gave out. The fruit, which is a sort of glorified edition of the American wild

strawberry, has the same concentrated sweetness, but more of it. Being different from the ordinary cultivated strawberry, it has the advantage of coming to the table with a note of freshness — inaugurating a little season of its own rather than extending a season already, perhaps, beginning to pall on the appetite.

"The plants, which run about eight inches high, began to bear last year on the 23d of June, and were picked for the table every day for four weeks. So that, if they are not strawberries of 'four seasons' literally, they have an unusually long fruiting period. They are very prolific, and very hardy. In short, they seem to have everything to recommend them to the average home garden, with nothing to be said adversely.

"This strawberry is grown in somewhat lighter soil than the ordinary kind. Plenty of manure is used when the plants are first set out, and then no more until a new bed is made. The plants fruit the first year, but much better the second. They are good for three years. By setting out runners every year, after the first, a complete succession of prime bearing plants is insured.

"While seed may be used to get a stock of plants started, runners are a better means of perpetuation after that. Sow seed in early spring. With the American winter as it is, very little is gained by autumn sowing, and always there is danger of mice injuring the plants. In either case the seed should be sown in a coldframe; but it may be sown outdoors in well-pulverized soil in April or May. Sow in a greenhouse in January. There are some varieties of Alpine strawberries that have no runners; these must be perpetuated by dividing the plants or by seed.

"Of the 'Quatre Saisons' type alone there are several varieties. In the experience of the grower of the strawberries referred to, these are the best of them at one time or another. They are the most reliable, and that is the main point.

"One of the finest of the improved 'Four Seasons' type is, he says, the Louis Gauthier — now popular in France. It is large, whitish, and very sweet. There are some Alpines very rich in flavour, actually white rather than merely whitish, and they are quite as easily grown.

"After a trial in both the Berkshires and central Connecticut, the grower mentioned (Mr. J. F. Huss) has abandoned the variety known at St. Joseph. It has fine fruit but — for his use; others may do better with it — he says that it does not bear abundantly enough to warrant the time and space given to it. This early variety is between the Alpine and garden types and is, I understand, synonymous with *Fragaria rubicunda*. It is practically perpetual, fruiting from June to September when the conditions are ideal. An improvement on it is called St. Antoine de Padoue. It has a musky flavour, and some do not care for it on that account. In England Belle de la Perrandière is very highly recommended by one of the best authorities. It is an Alpine and there fruits in September.

"The St. Joseph and the St. Antoine de Padoue are sold in this country, each with the claim that it bears fruit of fine flavour, colour, and size, and in abundance. Two other varieties offered are Leon XIII and La Constante. They cost more than the ordinary garden berry — one dollar a dozen. Seed of the ordinary 'Red Alpine' strawberry is quoted at ten cents a package.

"Alpine strawberries ordinarily ought to be sweet enough to eat without sugar. If anything is put on them, it would better be a little claret."

In selecting berries for seed planting, they should be allowed to get fully ripe before they are gathered. On picking them, they should be crushed, and thoroughly mixed with forty to fifty times their bulk of clean, dry sand. This sand will have a tendency to separate the seeds and also absorb the juice of the fruit. A flat of moist, sharp sand should be ready and the seeds with the sand should be planted in shallow furrows or sprinkled over the surface and lightly raked in. The flat is then thoroughly watered and placed below the bench in the greenhouse or in the propagating house, hotbed, coldframe or any suitable place of this kind.

If the planting be made in the middle of July, young plants may be expected to appear during the first week in August, if the sashes have been kept closed and the soil well wetted every day. As soon as the young plants appear in numbers they should be shaded. This is best done by whitening the glass. The frames may then be kept

closed a good part of the time, and the seedlings will grow so vigorously that they will bear transplanting in a few weeks to the bed where they are to remain and fruit. This method is well adapted for bringing seedling vines into bearing in the shortest possible time, as they get a very strong growth the first year.

The seedlings should be transplanted into beds of rich earth, encouraged to make stout, stocky plants, and to this end they should not be allowed to make more than one or at most two runners.

The seedlings may be set in the bed where they are to fruit, in rows two feet apart, with the plants eighteen inches asunder in the rows. If space is limited, the rows may be narrowed six inches, and the plants brought six inches nearer each other in the rows. If one or two runners are allowed to grow, they should be made to take root close to the parent plant.

The propagation of Bush Alpine is by division, as they do not produce runners. To propagate these varieties the old stools should be lifted early in spring and divided, leaving only one or two crowns to a plant.

If the old or central stems are very long, the lower or older part may be cut away, leaving only the upper and younger roots attached. In setting out again, the crown of the plant should be just level with the surface of the soil in order that new lateral roots may spring out above the old ones on the central stalk or stem.

Monthly Alpines are very valuable for forcing, as they will thrive in a lower temperature than those of other species, and, with ordinary care, will continue to bloom and bear fruit all the year round. Fruit is not produced in any great abundance at any one season, but, the crop being a continuous one, it amounts to a pretty fair quantity during the year. As an ornamental window or greenhouse plant there are very few bearing edible fruit worthy of more care or attention than the Monthly Alpine strawberry.

This Alpine type of strawberry should be encouraged among those who have the taste, capital or time, and the inclination. It is a valuable adjunct to the larger field of strawberry raising.

CHAPTER XIV

Fall-bearing Strawberries

The recent development of a group of varieties that would yield ripe fruits in the fall was looked upon with much interest by many admirers of the strawberry who saw great possibilities in their successful cultivation. Naturally the question is asked: Are these different from ordinary kinds or is this a new type of strawberry? The only difference noted between the common and fall-bearing kinds is that the latter have the characteristic of seemingly continuous bearing, or blossoming from May until the end of the growing period of the year. If the blossoms that first set are picked from fall-bearing varieties, another lot of blossoms will be produced in a few weeks. Continuing this method, blossoms will be borne as long as the growing period of the year permits. With the ordinary berries,

it is very unlikely that other flowers will appear later, if the first lot is picked.

These berries are practically a new race or type, the first of which, named Pan-American, originated on a farm in Cattaraugus County, New York, Mr. Samuel Cooper being the discoverer. While examining his beds of strawberries, in 1898, he was attracted by a parent plant and several young runner plants which were producing at this late season both blossoms and fruit. Mr. Cooper is not able to account for the freak o' nature. The parent plant, however, was in with a lot of Bismark plants, and is undoubtedly a sport of this variety, as the Pan-American has a great many of the characteristics of this parent.

Mr. Cooper, by the sowing of the seed of the Pan-American, was able to produce other varieties. The first seedling of value, although not of much more value than the Pan-American, was the Autumn, a pistillate variety. It was possible by using the former (which has perfect blossoms) and the latter to crossbreed and obtain varieties that were of more value. The results are seen in Productive and Superb, two berries which

are a great improvement over their parents. It is reasonable to expect more and improved varieties from Mr. Cooper's valuable experience.

Besides Mr. Cooper, several others are working on these fall-bearing varieties. Mr. Louis Huback of Arkansas; Mr. Edwin H. Riehl of Illinois; Mr. L. J. Farmer of Pulaski, N. Y., and others have been experimenting and raising seedlings. Mr. Harlow Rockhill, however, is perhaps the man that has secured the most marked practical results. Two of the best of his seedlings, Francis and Americus, have proved remarkably successful. They are a decided advance over all former fall-bearing varieties.

NEW VARIETIES

New varieties are obtained as described in the chapter on "Breeding." The method used by Mr. Cooper in raising his new varieties may be of interest:

He first makes the crosses, then gathers the fruit when fully ripe and mushes it to a pulp and mixes with sand. A smooth piece of soil is selected in the garden, and the seeds sown there in July or early in the fall. They

are gently stirred into the soil with a garden rake. A wide board is laid over the place where the seeds are sown, and left on until spring. Some of the seedlings will show in the fall, but most of them will not come up until spring. The board is put on to keep the weeds from growing and the seeds moist so they will sprout. Of course the board is removed in the spring. The young seedlings will come up very thickly and will have to be separated and given more room. It may be necessary to transplant them several times. Finally, they are set out the usual distance in the field and allowed to grow and fruit. Some of them will show fruit the first year, but most of them will have to be carried over until the following season.

After the seedlings are produced, they need to be fruited and selected for advancement. This judging of improvement in new varieties requires great skill, and that is the result of experience.

SOIL

The best soil in the garden should be selected for the fall berries. There should

be plenty of humus in this soil, and enough plant food to grow the plants properly as well as to produce a full crop of juicy fruit. It is of particular importance that the question of moisture have very careful consideration, as at the season of this plant's blossoming and subsequent fruiting it is oftttimes quite dry. If necessary, some form of irrigation, as spoken of in another chapter, should be practised.

PLANTING

The planting of the fall-bearing strawberries does not differ materially from that of the more common varieties. Being, however, a newer type, and in some cases a test or experiment, it is advisable to start carefully, and to follow a somewhat intensive system of planting, such as the single or double hedge-row method. These methods are also suitable as these fall varieties do not have a tendency to produce many plants.

CULTURAL METHODS

Clean culture and intensive work, the methods considered in another chapter, should be the system employed with these

varieties of strawberry plants for the best results. Mulching with straw should be practised during the winter. The blossoms have to be picked from the plants every two or three weeks up to the first of August, then they are allowed to produce fruit. September 1st, or thereabout, should be the date when mature, edible berries are ready for picking. This picking should be looked after quite carefully, as sometimes it becomes necessary to pick the fruits before they have coloured up much, or they will rot on the plant. The first berries, owing to the greater amount of sunlight, will have better colour and correspondingly better flavour. Later, owing to the cold weather, and the lack of sunlight, the flavour and colour will be less satisfactory. If the fruit is produced for the markets, it should be very carefully sorted and graded, in order to receive the highest price paid for this out-of-season product.

YIELDS

Owing to the fact that there are no large areas of fall strawberries, it is practically impossible to give any idea of just what

COMMERCIAL CULTURE

Level ground, which has been fitted properly, planted correctly, and given every opportunity for maximum production, will generally respond surprisingly to such treatment

IN THE FIELD

A convenient picking tray or "stand" is necessary for carrying the filled baskets to the shed where they are inspected and crated

the yield should be. Perhaps if the suburbanite or farmer had fifty plants in his garden he might have reason to expect twelve to fifteen quarts of fall berries, in some cases more, and, under other circumstances, less. These berries would sell at this time for at least 25 cents per quart, and if properly graded more would be paid. It would be natural to expect a high price for the product, not only because it is out of season, but because the production of the fruit costs more, as there is the increased expense over the ordinary growing of strawberries of picking off the blossoms, and, perhaps, better cultural methods. However, there is one advantage that would have a tendency to counterbalance the above — i. e., it is possible to plant fall-bearing strawberry plants early in the spring, and, by the best of care, fertilizer, water, etc., to produce fruit in the *fall of the same year*, thereby receiving returns in a shorter period than from the ordinary sorts.

It is not advisable for people blindly to buy or invest large sums in these fall berries; the best plan being to try a few and find out their peculiarities, then increase the area

only if the demand warrants it. The farmer or suburbanite, however, can add much to the enjoyment of living by trying out a few of these varieties, and having the fresh products for his own use in the "out-of-strawberry" season.

CHAPTER XV

What Is the American Strawberry?

The strawberry has only received much attention during the last seventy-five or one hundred years. The first variety of which we have any account is the Fressant, which dates from 1660. There are but few wild species of strawberries, and only some few of these ten or twelve species have been brought into cultivation.

The European common wild strawberry includes both the Annual and Monthly Alpines, as well as the White and Red Wood strawberries. The former are indigenous to North America, being found quite plentifully from the east northern states, also westward to the Rocky Mountains, where they grow in the cooler regions and on the more elevated places. These Alpines do not produce runners to any extent, but grow in stools or clumps. The fruit produced

is small, oblong or sharp-pointed, having varieties that are either red or white. The plants are thin and very slender, with leaflets of a pale-green colour. This was of the type of our first strawberries quite similar to the Fressant.

These European types, which are grown in some parts of continental Europe, especially in France and Switzerland, are, however, in England and America, but little more than rarities or curiosities. This being the case, it is more desirable to direct attention to the class of large American and European strawberries. This latter type, although profitably grown in all temperate countries, seems to have come to great prominence first in England, where considerable experimenting was done. It is furthermore the only American market strawberry.

The common small species of eastern America, which is known to botanists as *Fragaria Virginiana*, was the first foreign strawberry to reach Europe. Mention, as well as the first distinct record of this event, was made in 1624 by Jean and Vespasian Robin, who were at that time gardeners to Louis XIII. No new or striking forms were

taken by this strawberry during the following one hundred years. From the description, that it bore small, bright scarlet berries, with a distinct neck or constricted area near the stem and more or less slightly acid flesh, it is probable that it was not very different from the common wild strawberries which are found in the fields of the Northeastern States. This berry met with great favour in England, but on the continent it was not considered of any value.

About 1712 a second species of strawberry reached Europe. Captain Frezier brought from Chile to Marseilles a strawberry that is named botanically *Fragaria Chilœnsis*. It was not until 1724 that this fruit reached England. This plant, which is a shaggy, thick-leaved, stout individual, bearing large, dark-coloured, somewhat pointed, globular fruit late in the season, did not meet with great favour, particularly so as the flowers were often imperfect, thereby lacking the self-pollinating benefits. However, in a few places, especially at Brest in France, it was after a time grown and cultivated for its fruit.

Barnet in writing about this berry a hun-

dred years later knew of but three varieties in England that he could in any way refer to it. One of these three, he considered, had not changed from the original plant as brought from Chile by Frezier. In fact, at this date it seemed to be very little cultivated.

This species, which grows wild along the Pacific Coast in both South and North America, has been introduced from these sources into the gardens of the eastern United States several times. However, it has very soon disappeared.

The fact then presents itself that there is very little of promise in the record of this species for the horticulturist of this country.

Between the years 1750 and 1760, or thereabout, a third strawberry appeared in Europe. The exact date of its introduction is not known, contrary to the opinion of many writers. Philip Miller in 1760 describes it as the Pine strawberry, referring, no doubt, to the pineapple fragrance of its fruit.

Three distinct reports as to its origin were in circulation; the first gave Surinam, which is now on the coast of Dutch Guiana, as its home. This opinion was one that came

from Holland. Another report gave credit to Virginia, and still another claimed that it came from Louisiana. Not one of these reports has been either corroborated or confuted.

Upon comparing the Pineapple strawberries of England and France, they were found to be different from each other. The difference was not greatly marked, and the majority of botanists in a few years came to regard the two as variations such as might arise within the limits of one stock or type.

This type of Pine strawberry has been known for over a century as *Fragaria grandiflora*, although this name, which was given it by Ehrhart in 1792, together with the English name Pine, is fast passing out of use. Duchesne established it in a distinct species, named *Fragaria calyculata*. This species was represented by the Bath Scarlet, a large hulled type.

Besides the above three theories as to the origin of the Pine strawberry, there are at least two other hypotheses that must be taken into consideration. One has the acknowledged certification of Duhamel, De

Candolle, and Guy, that it is an absolute modification of the Chilean strawberry. The other was brought forth by Decaisne, and quite readily accepted by others, that some, at least, of the varieties of this strawberry are the offspring or variations of the large, robust native form of the species *Fragaria Virginiana*, var. *Illinœnsis*, our wild strawberry.

We must, however, determine from what progenitor type our cultivated strawberries have sprung. In 1824, according to the writings of Barnet, he divides all cultivated strawberries into seven classes. The first (1) of these is the Scarlet or Virginian strawberry with twenty-six varieties; the second (2) is Duchesne's *Fragaria tincta* or black strawberry, with five varieties; third (3), the Pines or Pineapple strawberry, with fifteen varieties; fourth (4), the True Chile strawberry, with three varieties. The remaining three classes comprise the small European varieties. These latter will not be considered, as they are outside of the question. It is possible to class the Blacks and Pines as one, owing to their being so much alike. This last class, although the youngest, had already

varied into more than twenty forms, many of which were the choice of all the varieties. One of these, in the extra choice class, was Keen's Seedling, which was at this time just coming into great importance. This variety was, in fact, the first worthy contribution to our present commercial strawberry culture, and an epoch maker. It was produced from the seed of Keen's Imperial, this latter being raised from the White Carolina, or Large White Chile. Barnet regards this last as a true Pine strawberry.

The present English strawberries have to a great extent descended from Keen's Seedling. In 1821, at London, the fruit of this seedling was first shown. There were apparently few, if any, varieties in England at this time that were of American origin. In 1828, Prince writes, of the thirty strawberries in American gardens, all but one were of foreign origin. The two most important varieties, as well as the ones which supplied practically all of the fruit sold in the New York market, were Red Chile (which is classed by Barnet and Lindley with the Pines) and Early Hudson (which was undoubtedly a variety of *Fragaria Virginiana*).

Hovey, as well as other writers, claimed that Keen's berries, although on the market list, did not thrive well in the United States. Hovey wrote in 1837 that "as yet the plants of nearly all the kinds in cultivation have been introduced from the English gardens, and are not suited to the severity of our climate."

Mr. Hovey, who was a very shrewd man and a practical breeder of rare ability, decided to produce a berry that would be satisfactory in our climate. He selected parents which showed the best adaptation to American conditions, and which represented his distinct high ideals.

By crossing two Pines, Keen's Seedling and Mulberry, also Melon, which was undoubtedly a Pine, and Methven Scarlet, a variety of the Virginian, he was able to obtain two varieties, which he named Hovey and Boston Pine. Mr. Hovey lost his labels on these crosses, and it is not positive just which crosses gave these varieties. However, he was always quite certain that the Hovey was the result of Mulberry crossed by Keen's Seedling.

This Hovey strawberry was an epoch

maker, just in the same way as was the Keen's Seedling. It practically marks the second great step in the advancement of commercial strawberry growing.

From this time on new American varieties began to appear, the greater part of them being direct descendants of Hovey and the Boston Pine. However, the majority came from the former. The latter and its immediate offspring soon passed out, and to-day in American strawberry literature the term Pine has been practically lost. This is not because the Pine class has become extinct, but, quite to the contrary, the Pine class has driven out all other classes, and has become the dominant one. The Hovey is a fine example of a true Pine, with its thick, rounded, dark leaves, stocky habit, stiff flower cluster, and large, spreading calyx. Practically all of our commercial strawberries of to-day are Pines, and they compare well in botanical characters with the important Pines of Barnet's time, such as the Bath Scarlet, as well as the *Fragaria grandiflora* of the French gardens of seventy-five or one hundred years ago.

If these things are true, then our straw-

berries are lineal descendants of the botanically known *Fragaria ananassa* and *Fragaria grandiflora* or common old Pine class.

The question now arises, "What is a Pine strawberry?" Bailey in studies on this subject, in order to determine for himself, sent to Oregon for wild plants of *Fragaria Chilœnsis*. These were quite easily distinguished from ordinary garden strawberries, owing to the fact that they were short, stocky, thick-leaved, hairy evergreen plants. After two years of close observation he was able to find a remarkable difference between a pressed plant of the Oregon species and plants of the same species that had been under cultivation during this period. In fact, the characteristics of the wild plants under culture had changed so much that it was quite difficult to recognize them from ordinary garden sorts. This change was brought about undoubtedly by the variation induced through the changed environment of the plant. It is a well-known fact that such is the case in other plants. If artificial selection is then given, plants may be changed to a still greater degree.

De Candolle, Seringe, and others about

1825 held the opinion that the Pine, Bath Scarlet, and Black strawberries all belonged to the *F. Chilœnsis*. The Dutch gardeners also held this idea, as well as the Dutch merchants who sold the Pine strawberries under the name of *Fragaria Chilœnsis ananæformis*. Duhamel also claimed that the seeds of the *F. Chilœnsis* would produce the Pine strawberry.

The conclusion, therefore, is that the garden strawberries, although greatly changed or modified, are direct descendants of the *Fragaria Chilœnsis*, or Chile strawberry.

CHAPTER XVI

Varieties for Special Purposes

One of the first questions asked by any person who is thinking of growing strawberries is not how to plant them, or fertilize them or otherwise care for them, but rather which variety to plant. In talks between neighbours, be they farmers or suburbanites, it is always, "My * * * strawberries are doing fine, they are extremely large, juicy, and a banner crop." Also when a friend is visiting and there are strawberries to be inspected, the first question is, "What variety is that?"

It does seem from the above (and the author's experience in both growing and selling plants and berries supports this), that one of the first and most important questions is that of what variety to choose.

One of the first considerations in the choice of varieties is personal taste. This personal taste, however, would have more

leeway in a private fruit garden than in a large commercial place, but, for success in growing strawberries in either case, it is a very important factor. Some individual's taste is for a deep red berry with considerable length from hull to tip; another wants a berry the same colour and wider than it is long, or coxcomb. A third person desires a berry with a broad-shouldered top, a medium large, well-placed calyx or hull, and a gradual rounding, top-shaped appearance, the stem and calyx to remain a bright green and the berry to be from a light crimson to a deep rich scarlet, the seeds being slightly red and not over conspicuous. A berry like the Sample, Lady Thompson or Warfield would seem to answer very nearly to this description.

There are other characteristics as to shape of berries, size of berries, colour of berries, shipping qualities, size and colour of calyx, and also seeds as well as conspicuousness of both, which are taken into consideration in selecting a variety for planting.

Besides these exterior appearances, a large number of people consider the flavour, from very acid or tart to nearly the sweetness of

the native wild fruit. It is a fact that some people would not think they were eating strawberries without a rather tart flavour being given, while others have gone so far in their demands that the berries must have more of the sweet wild flavour, that breeders have tried to obtain a berry of large size, containing one eighth to one half or more of the wild in its makeup, and this wild quality must be given in increased sweetness of the berry.

As well as the flavour, the quality of the flesh is a personal taste, whether the flesh is fine grain, of one solid colour or with a dark rim and light toward the centre, having also the quality of mashing easily (making a poor shipper but a good home berry), or whether it is coarse flesh of solid colour or not, and a good, hard shipper. There is generally some coördination between the poor shipper, a fine-grained berry with increased sweetness, and the good shipper, a coarser berry with increased acidity.

As was said just before, these factors of personal taste in strawberry raising are greater for the home grower, as his garden is the direct result of individual likes

and dislikes. Commercially, these factors do not enter in so much, as far as the grower is concerned, but are the direct results of the popular demand in the markets catered to, and of course this demand is more or less made up of the personal taste of the buyers. The large grower may, however, force, in a manner, the sale of a berry of his choice by many of the factors of sale, such as more attractive package, correct packing, and better advertising. Nevertheless, as a general rule, the commercial grower must have a berry the colour and quality of the markets' demand, and this berry must be a good shipper as well as a large producer of good-sized fruit.

In a careful study of the various markets of our country, it has been found that first-class, well-packed attractive package strawberries are, practically without an exception, never over supplied, but there is at times, in some of the markets, an oversupply of lower grades of fruit, which tends toward a glutted market, and a decreased price for even the high-priced number one fruit.

The best advice to the commercial grower is, study the demands of your market, then

get a variety that will supply this demand and keep up your standards of berry, package, and packing, preferring rather to ship your seconds to a more distant market or to the cannery, rather than have them compete with, and thereby reduce, the price of your fancy fruit. Canneries are glad to obtain the fruit that is grown for the general market.

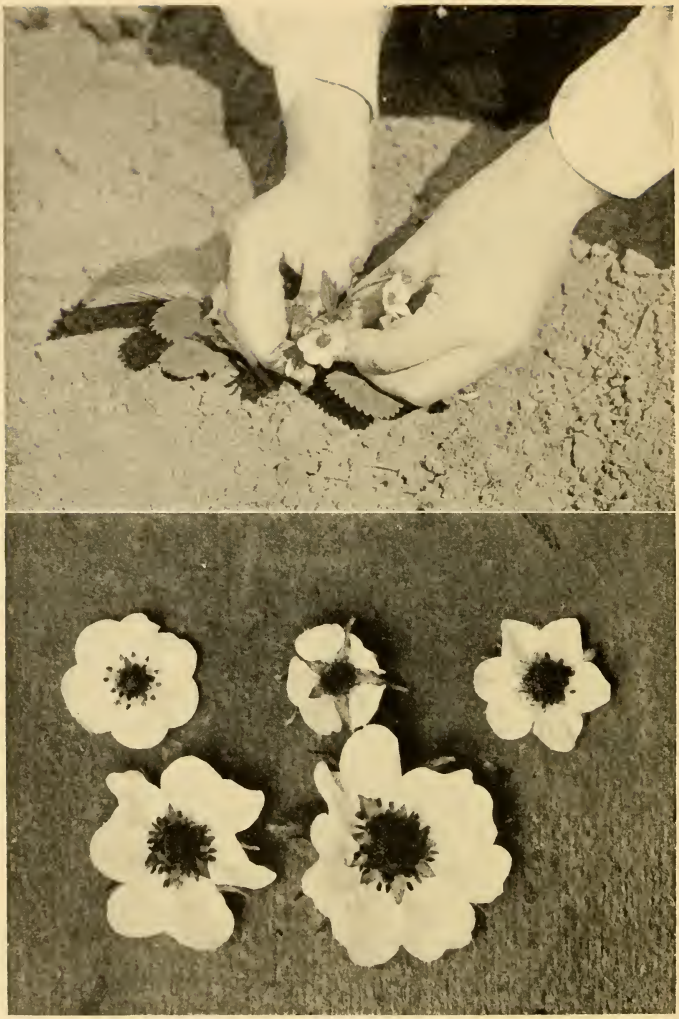
Proper pollination of the fruits is one of the great factors of successful strawberry growing. Very few people realize that there is a difference in the flowers of strawberries.

It is very fortunate that practically all the commercial growers of plants state in their catalogues whether or not a plant produces (P) pistillate or (B) bi-sexual flowers, thereby saving the grower value, time, and money.

No attempt is here made to present a complete catalogue of present-day varieties, and new ones come along each season. I have, however, taken note of the best varieties as I see things, and these tables are offered as guides rather than as unalterable facts.

WEATHER AND FRUIT PROSPECTS

Above: Blossoms of Glen Mary as produced in cloudy weather — no pollen.
Below: Blossoms of same variety produced in sunny weather — plenty of stamens and pollen, which make fruit later on



STRAWBERRY FLOWERS

Pick off the blossoms the first year if you would have strong plants later. The lower photograph shows how the bloom of varieties may differ. Those shown are, in order from the top left: Marshall, Carrie, Margaret, Brandywine, and Glen Mary

ADAPTED FOR HOME PLANTING

Americus
Autumn
Bederwood
Brandywine
Cardinal
Clyde
Francis
Gandy
Glen Mary
Haverland
Helen Davis
Klondike
Marshall
Michel's
Pan-American
Productive
Sample
Senator Dunlop
Texas
Wm. Belt.

ADAPTED FOR COMMERCIAL PLANTING
(Not Canning)

Brandywine
Bubach
Cardinal
Chesapeake
Clyde
Excelsior
Gandy
Glen Mary
Haverland
Helen Davis
Highland
Klondike
Lady Thompson
Michel's
Parson's Beauty
Sample
Senator Dunlop
Stevens
Texas
Warfield
Wm. Belt
Wilson

ADAPTED FOR CANNING

Brandywine
Bederwood
Clyde
Haverland
Parson's Beauty
Texas
Warfield
Wilson

VERY GOOD SHIPPERS

Cardinal
Gandy
Glen Mary
Helen Davis
Michel's
Parson's Beauty
Sample
Texas
Warfield

GOOD SHIPPERS

Brandywine
Bubach
Chesapeake
Highland
Klondike
Lady Thompson
Marshall
Productive
Senator Dunlop
Stevens
Wm. Belt
Wilson

FAIR TO GOOD SHIPPERS

Bederwood
Clyde
Excelsior
Haverland

EXTRA EARLY FRUITING

Excelsior
Michel's
Texas

EARLY FRUITING

Bederwood
Clyde
Helen Davis
Highland
Warfield

MEDIUM SEASON FRUITING

Bubach
Glen Mary
Haverland
Klondike
Lady Thompson
Senator Dunlop
Parson's Beauty
Wm. Belt
Wilson

LATE FRUITING

Brandywine
Cardinal
Chesapeake
Marshall
Sample

VERY LATE FRUITING

Gandy
Stevens

FALL FRUITING

Americus
Autumn
Francis
Pan-American
Productive

STRONG POLLENIZERS

Bederwood
Michel's
Parson's Beauty
Senator Dunlop
Wm. Belt

GOOD POLLENIZERS

(But not in the Strong class)

Americus
Brandywine
Chesapeake
Clyde
Francis
Helen Davis
Klondike
Lady Thompson
Marshall
Pan-American
Stevens

WEAK TO FAIR POLLENIZERS

Excelsior
Gandy
Glen Mary
Texas

ADAPTED TO INTERPLANT FOR POLLENIZATION

Bederwood B with Highland P.
Bederwood B with Warfield P.
Bederwood B with Bubach P.
Senator Dunlop B with Haverland P.
Wm. Belt B with Glen Mary B (weak).
Senator Dunlop B with Cardinal P.
Senator Dunlop B with Gandy B (weak).
Senator Dunlop B with Sample P.
Pan-American B with Autumn P.
Pan-American B with Productive P.

VERY HEAVY YIELDERS

Bubach
Gandy
Highland
Klondike

Glen Mary
Haverland
Helen Davis
Parson's Beauty
Sample
Senator Dunlop
Texas

GOOD YIELDERS

Bederwood
Brandywine
Cardinal
Chesapeake
Clyde
Excelsior
Lady Thompson
Michel's
Stevens
Warfield
Wm. Belt
Wilson

FAIR TO GOOD YIELDERS

Francis
Marshall

VERY LARGE BERRIES

Brandywine
Bubach
Chesapeake
Clyde
Glen Mary
Helen Davis
Marshall

LARGE BERRIES

Cardinal
Francis
Gandy
Haverland
Highland
Klondike
Lady Thompson
Parson's Beauty
Sample
Senator Dunlop
Stevens
Texas
Wm. Belt
Wilson

MEDIUM SIZE BERRIES

Americus
Bederwood
Excelsior
Michel's
Productive
Warfield

DARK RED BERRIES
(on clay soils)

Americus
Excelsior
Parson's Beauty
Productive (unattractive)

Marshall
Pan-American (dull red)
Senator Dunlop
Texas (dark red cheek)
Warfield

RED BERRIES

Klondike
Michel's (crimson to red)
Sample (light red)
Stevens

CRIMSON BERRIES

Brandywine
Cardinal (light crimson)
Clyde
Gandy (light crimson)
Glen Mary
Helen Davis
Lady Thompson
Texas
Wm. Belt (dark crimson)
Wilson (dark crimson)

SCARLET BERRIES

Americus (light scarlet on soils other than clay)
Bederwood (light scarlet)
Bubach
Francis (light scarlet, glossy)
Haverland
Highland

BERRIES OF VERY GOOD QUALITY

Brandywine
Bubach
Cardinal
Chesapeake
Clyde
Gandy
Glen Mary
Haverland
Helen Davis
Klondike
Marshall
Michel's
Pan-American
Sample
Texas
Warfield
Wm. Belt
Wilson

BERRIES OF GOOD QUALITY

Americus
Autumn
Bederwood
Excelsior
Highland
Lady Thompson
Parson's Beauty
Senator Dunlop
Stevens

BERRIES OF FAIR QUALITY

Francis
Productive

LARGE ROOT DEVELOPMENT, DROUGHT-RESISTING PLANTS

Autumn
Bederwood
Glen Mary
Lady Thompson
Stevens

VERY GOOD PLANTMAKERS

Michel's
Stevens
Warfield

GOOD PLANTMAKERS

Autumn
Glen Mary
Klondike
Lady Thompson
Parson's Beauty
Sample
Senator Dunlop

WEAK PLANTMAKERS

Francis
Gandy
Marshall
Pan-American
Texas

COSMOPOLITAN AS TO SOIL

Bubach
Cardinal
Glen Mary
Wm. Belt

FAIR TO GOOD AS TO ADAPTABILITY TO SOILS

Parson's Beauty
Senator Dunlop

VARIETIES FOR A CLAY SOIL

Americus
Gandy

STRONG FROST RESISTERS

Cardinal
Chesapeake
Gandy
Haverland
Pan-American

DISEASE FREE VARIETIES

Cardinal
Chesapeake

SPECIALLY ADAPTED TO GREENHOUSE FORCING

Marshall

ADAPTED TO HILL METHOD AND HIGH CULTURE

Autumn
Gandy
Marshall
Productive
Senator Dunlop

KEY TO VARIETY CHART ON FOLLOWING PAGES

Origin Ark.—Arkansas. Ill.—Illinois, etc.

Sex B.—Bi-sexual. P.—Pistillate.

Season Ex. Ey.—Extra Early. Ey.—Early. Med.—Medium. L.— late, etc.

Popularity Mid. S.—Mid-South. M. W. — Mid-West. E. W.—Everywhere, etc.

Pollenizer F.—Fair. V. G.—Very Good. W.—Weak. G.—Good

Shipper F.—Fair. G.—Good, etc.

Yield F.—Fair. G.—Good, etc.

Form C.—Conical. Obl.—Oblate. R.—Roundish.

Size M.—Medium. L.—Large. V.L.—Very large. S.—Small.

Colour D.—Dark. R.—Red. C.—Crimson. S.—Scarlet. L.—Light.

Quality G.—Good, etc.

Meat L.—Light. R.—Red. D.—Dark. S.—Scarlet. C.—Crimson.

Calyx G.—Green. Lt.—Light. B.—Bright. M.—Medium. L.—Large. S.—Small.

Uses Des.—Dessert. Com.—Commercial Market. Can.—Cannery.

Foliage T.—Tall. L.—Light. Lg.—Large. V.—Very. G.—Green. Vig.—Vigorous. H.—Healthy. Y.—Yellowish. B.—Bright. D.—Dull. Upr.—Upright.

Name of Variety	Origin	Sex	Season	Popularity	Pollinizer	Shipper	Yield
Americus	Iowa	B	Fall	N E	F to G	?	F
Autumn*	N. Y.	P	Fall	?	....	?	F
Bederwood†	Ill.	B	Ey to M	W	V G	F to G	G
Brandywine	Pa.	B	L	E	G	F to G	G
Bubach	Ill.	P	M	W	....	G	V G
Cardinal	Ohio	P	L	N	....	V G	G
Chesapeake	Md.	B	L	E	G	G	G
Clyde††	Kan.	B	Ey to L	Ky	F to G	F to G	G
Excelsior	Ark.	B	Ex Ey	Mid S	F	F to G	G
Francis‡	Iowa	B	Fall	N E	F to G	?	F to G
Gandy	N. J.	Weak B	V Late	E M W	W	V G	V G
Glen Mary	Pa.	B	M	E & W	W	V G	V G
Haverland	N. J.	P	M	E	....	F to G	V G
Helen Davis	Ind.	B	Ey	M W	F to G	V G	V G
Highland**	?	P	Ey	M W	....	G	V G
Klondike	La.	B	M	S	F to G	G	V G
Lady Thompson¶	N. C.	B	M	S	F to G	G	G
Marshall	Mass.	B	L	E & W	F to G	G	F to G
Michel's	Ark.	B	Ex Ey	M S	V G	V G	G
Pan-American	N. Y.	B	Fall	?	F to G	?	F
Parson's Beauty	?	B	M	N	V G	V G	V G
Productive	N. Y.	P	Fall	N	....	G	F
Sample	Mass.	P	L	E	....	V G	V G
Senator Dunlop	Ill.	B	M	E & W	V G	G	V G
Stevens	N. J.	B	V L	E	F to G	G	G
Texas	Texas	B	Ex Ey	E & W	F	V G	V G
Warfield	Ill.	P	Ey	E M W	....	V G	G
Wilson	N. Y.	B	M	E N Y	F to G	G	G
Wm. Belt	Ohio	B	M	E & W	V G	G	G

*Fruit D R colour on clay soil.

†Long bloomer, produces large amount of pollen.

††Requires best management for success.

‡Young foliage small, feeble; old foliage vigorous, healthy.

**Light yellowish green foliage.

¶Fruit stems long.

	Fruit						
Form	Size	Colour	Quality	Meat	Calyx	Uses	Foliage
R. Obl.	M	L S	G	L S	.....	Des	L G
R	S to M	Rich R	G	R	.....	Des	Vig D G
R C	M	L S	G	Firm L S	S	Can Des	D G. T
Obl. C.	V L	C	V G	L C	.....	Can Des Com	
R. Obl.	V L	S	V G	L S	L	Com	Waxy D G
R C	M L	L C	V G	L C	.....	Com Des	L Tough
R C	V L	R	V G	L R	.....	Com	.....
Obl. C.	L to V L	C	V G	Pink Firm	M	Com Des Can	Weak
C	M	D R	G	L inside R outside	L G	Com Des	.....
Irreg. Cocksco'b	M to L	L S Glossy	F	L S	.....	Des	Glossy L G D G. T.
C	L	L C	V G	V L C	.....	Com Des	Leathery
R C	V L	C	G to V G	L C	L	Com Des	V L Y G
Obl. C.	L	S	G to V G	L S	M to L	Com Des	Y G
C	L to V L	C	V G	L C to C	M to L	Des Com	L G
C	L	S	G Juicy	Solid S	M	Com	Lg. H. Vig
Obl.	L	R	G to V G	R to S	S	Com Des	T. L G
R. Obl.	L	C	G	L C	Double	Com Des	Ex T. L G
R C	V L	D R	V G	R	L	Des	Ex Lg L to D G
Obl. C.	M	C to R	V G	Deep Pink	L to G	Des Com	L G. T Upr
C	S to M	L dull R	G to V G	R	.....	Des	D G. Vig
Obl. C.	M L	D R	G Mild	R	.....	Can Com	L. D G Upr
C	M	D R Unattr	F Firm	R Firm	.....	Des	L. Thick Glossy
R C	L	L R	V G	C	S	Com Des	L G
R C	M to L	D R	G	R	.....	Com Des	T. B G
R C	L	R	G	L R	M	Com	L G. Vig
C	M to L	D R	V G	R Firm	L B G	Des Com Can	.....
Ideal C	M	D R	G to V G	D R	L	Com Can	Vig
C	M to L	D C	G to V G	C	....	Can Com	....
Obl. C.	L	D C	V G	C	....	Com Des	.....

There is a worthy attempt on the part of the American Pomological Society to separate or divide up the United States into eighteen districts and name the fruits that are particularly adapted to each district as well as those which are worth trying. This is a most valuable work and should be brought up to date each year in the case of strawberries. The map here reproduced (on page 205) is from Bulletin No. 151, Division of Pomology, United States Department of Agriculture.

The planter should consult the map to determine the division in which he is located and study the following list of suitable varieties to plant in his section:

Div. 1: Bederwood, Bubach No. 5, Clyde, Crescent, Haverland, Warfield, Wilson.

Div. 2: Bubach No. 5, Clyde, Crescent, Gandy, Haverland, Michel's Early, Sharpless, Warfield, Brandywine, Wilson.

Div. 3: Wm. Belt, Bederwood, Bubach No. 5, Gandy, Haverland, Lady Thompson, Warfield, Brandywine, Wilson.

Div. 4: Bederwood, Bubach No. 5, Crescent, Gandy, Haverland, Michel's Early, Lady Thompson, Warfield, Brandywine, Wilson.

Div. 5: Gandy, Michel's Early, Lady Thompson, Wilson.

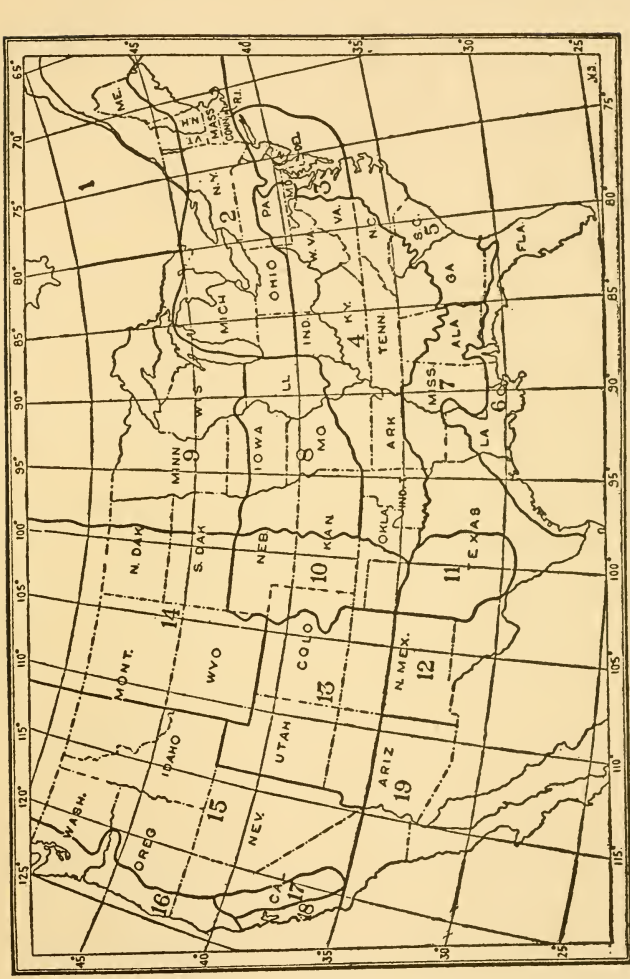
Div. 6: Michel's Early, Lady Thompson's Brandywine, Wilson.

Div. 7: Brandywine, Bubach No. 5, Crescent, Gandy, Glen Mary, Michel's Early, Lady Thompson.

Div. 8: Bederwood, Bubach No. 5, Crescent, Gandy, Haverland, Michel's Early, Sharpless, Warfield, Wilson.

Div. 9: Bederwood, Crescent, Warfield, Brandywine, Wilson.

Div. 10: Crescent, Gandy, Haverland, Warfield, Brandywine.



Map showing the Pomological Divisions of the United States, as adopted by the American Pomological Society. The recommended varieties of strawberry for the various divisions are given on pages 204-6.

Div. 11: Hoffman and Michel's Early are the only sorts mentioned as having proved themselves adapted to this region in the list prepared by the American Pomological Society.

Div. 12: Brandywine, Sharpless and Lady Thompson where irrigation can be provided.

Div. 13: Bederwood, Crescent, Haverland, Sharpless, Wilson.

Div. 14: Crescent, Bubach No. 5, Gandy, Haverland, Brandywine, Wilson.

Div. 15: Jessie, Parker Earle, Sharpless, Wilson.

Div. 16: Hood River, Sharpless, Brandywine, Wilson.

Div. 17: Sharpless, Brandywine.

Div. 18: Jessie, Sharpless. These sorts are only fairly well adapted to the region.

Div. 19: Sharpless, Lady Thompson.

ORDERING PLANTS

One of the hardest things to decide upon is from whom to order plants. As a general rule, it is best to obtain them from a grower who raises them near one's home. In a great many cases plants can be obtained from this source that are adapted both to the climate and the soil, as well as to the market.

Then another consideration is that the plants can be dug in the morning and planted at once, and the largest amount of root surface will be retained, roots will not dry out, and the chances of successful transplanting will be greater.

However, desirable plants ofttimes cannot be obtained nearby and it is then advisable to

EVERY PLANT A QUART

This is the yield that well-grown plants should give when the bed is at its best

ONE REASON FOR A BAD CROP

Cross pollination is usually necessary. The Glen Mary plant (on the right) and Marshall (on the left) had only their own pollen available. Brandywine (in the centre) has set fruit well from its own pollen.
Moral: Put several varieties together

patronize one of the large reliable strawberry plant specialists who offer specially grown and pedigreed plants. Most of these firms advertise in reliable farm and garden papers, and will treat your order, whether it be large or small, with all due consideration. It is best in ordering not only to specify the variety, number of plants wanted, but also whether you desire the roots or leaves pruned, about what time you would want to receive the plants, shipping directions, and some of your conditions under which you are going to place the plants, such as location, soil, etc.

The best time to order plants is in the late winter. Do not wait until the rush is on and some one else has secured the cream of the plants, but have your order in early and give the grower a chance and time to attend properly to your shipment.

The foregoing descriptions of the successful varieties of strawberries must not be taken too literally by the amateur. It would be better for him to take them more as a guide, and test each of his selections before planting on any large scale.

It would also be advisable for him to make inquiries of successful growers in his section,

giving special reference as to soil, moisture, site, interplanting or interpollination and other points. It will often be found that there is some variety other than any one here mentioned that is particularly adapted to the local conditions and market.

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